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Physics Abstracts

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Electronic relays and counters	Photocells	Electroacoustic apparatus
Automatic control mechanisms	Thermionic tubes	Radiocommunication
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PHYSICS ABSTRACTS

Volume 58 JANUARY 1956 Number 603

MATHEMATICS 51

512.312

1. A DIRECT ITERATIVE PROCESS FOR HURWITZ FACTORIZATION OF A POLYNOMIAL. F.L.Bauer.
Arch. elekt. Übertragung, Vol. 9, No. 6, 285-91 (June, 1955). In German.

A real polynomial $Q(\lambda^2)$ may be resolved into two real factors, $Q(\lambda^2) = E(\lambda)E(-\lambda)$, called the Hurwitz factors. A numerical method is described for doing this. It is an iterative method based on the triangular decomposition of a certain infinite matrix related to the polynomial. Some remarks are made about the speed of convergence. L.S.Goddard

517

2. CALCULATION OF INTEGRALS OF THE FORM $C_m = \int_1^\infty \lambda^m(\lambda^2-1)^{\frac{1}{2}}e^{-a\lambda}\,d\lambda$ (m an integer). J.Guy and J.Tillieu.
J. Phys. Radium, Vol. 16, No. 10, 801-2 (Oct., 1955). In French.

The integrals arise in the calculation of the magnetic susceptibility of the hydrogen molecule. They are evaluated in terms of derivatives of Hankel functions, and explicit formulae are given for the cases m = 0, 1, 2, 3, 4. L.S.Goddard

517.3

3. ON THE NUMERICAL INTEGRATION OF FUNCTIONS TABULATED IN LOGARITHMIC FORM. L. Jacchia.
Math. Tables Aids Comput., Vol. 9, 63-5 (April, 1955).

In some physical problems described by differential equations, it happens that one or more of the variables shows a range of variation of several orders of magnitude, and in such cases it is convenient to tabulate the variables in logarithmic form. It is shown how the usual finite-difference formulae for numerical integration can be adapted to integrate a function when only its logarithm is given. L. S. Goddard

519.2

4. THE INTERPRETATION OF EXPERIMENTAL RESULTS BY A REGULARITY CONDITION. P.Vernotte.
J. Phys. Radium, Vol. 16, No. 7, 63 S - 64 S (July, 1955). In French.

A description, in general terms (without formulae), of a method of smoothing observed series by making the differences of the smoothed series satisfy certain inequalities. It is pointed out that the method requires observations at rather finer intervals than are usually available. N.L.Johnson

ASTRONOMY . ASTROPHYSICS . GEODESY 52

523.11

5. ANISOTROPIC MODELS IN NEWTONIAN COSMOLOGY. I. F.Zagar.
R.C. Accad. Naz. Lincei, Vol. 18, No. 5, 452-8 (March, 1955). In Italian.

The nebular velocity field is assumed to be of the form $v_i = \alpha_i x_i$ where the 3 coefficients α_i are functions of t. The case $\alpha_i \propto 1/(t - t_*)$ is discussed. R.A.Newing

523.11

6. HYPOTHESIS FOR THE ORIGIN OF THE MAGNETIC FIELDS AND ANGULAR ROTATIONS OF STARS AND PLANETS. W.H.Bostick.
Phys. Rev., Vol. 100, No. 4, 1007-8 (Nov. 15, 1955).

From theoretical considerations it is to be expected that gravitational contraction of ionized material across a magnetic field will produce an enhancement of the magnetic field and a rotational angular momentum of the mass. This process may be associated with the magnetic fields and rotations of galaxies, stars and planets and may possibly play a role in expanding universe. A.

523.11 : 530.12

7. THE COSMOLOGICAL PRINCIPLE. D.E.Littlewood.
Proc. Cambridge Phil. Soc., Vol. 51, Pt 4, 678-83 (Oct., 1955).

It is claimed that the "perfect cosmological principle" of steady state theories leads to a definite model universe. As in kinematic relativity the model is described in terms of two time scales, but here there is an infinite past and future in the atomic t-scale and a finite future on the τ-scale. Therelation of the present model to that of Hoyle is discussed. R.A.Newing

523.161

8. RADIAL VELOCITIES OF INTERSTELLAR HYDROGEN IN EMISSION FROM DISTANT H II REGIONS. G. Courtès.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 364-6 (July 25, 1955). In French.

An interferential study of four regions of nebulosity, IC 1085, IC 1848, NGC 7380, NGC 7635, deliberately chosen in a galactic region exhibiting large negative radial velocities of −10 to −16 km/sec per kilo-parsec because of the differential galactic rotation. The results agree with expectation, and thus appear to confirm the distance of these objects. D. R. Barber

523.164 : 53.08

9. MEASUREMENT-TECHNIQUE PRINCIPLES OF RADIOASTRONOMICAL RADIATION MEASUREMENT. L.Mollwo.
Hochfrequenztech. u. ElektAkust., Vol. 64, No. 1, 1-8 (July, 1955). In German.

523.72 : 523.32

10. OBSERVATIONS OF SOLAR AND LUNAR RADIATION AT 1.5 MILLIMETERS. W.M.Sinton.
J. Opt. Soc. Amer., Vol. 45, No. 11, 975-9 (Nov., 1955).

Observations of the radiation from the sun and the moon in a wide wavelength band centred approximately at 1.5 mm are reported. These waves were detected with a Golay detector using a searchlight mirror for a telescope. Measurements of

atmospheric extinction are reported and compared with calculations of water vapour absorption which have been made by J.H.Van Vleck. It is found that the measured extinction is greater than the calculated. Observations of the radiation emitted by the moon at different phases are reported. The transmittances of some materials to the 1.5 mm waves from the sun are included. A.

523.73

11. DETERMINATION OF THE ROTATIONAL VELOCITY OF THE SUN AT THE (SUNSPOT) MAXIMUM OF 1948. K. Miloševič.
C.R. Acad. Sci. (Paris), Vol. 241, No. 7, 590-2 (Aug. 17, 1955). In French.

Measurements of the position on the solar disk of small chromospheric faculae during the sunspot max. period, 1947-8, when compared with corresponding data for the min. period, 1953-4, indicate that the angular velocity of solar rotation has remained constant during this half-cycle. This result is at variance with the conclusions of U. Becker (1954) and E. Schodo (1951); but agrees with the results of H. W. Newton and M. L. Nunn (1951). D. R. Barber

523.743

12. ON A VARIATION OF THE NUMBER OF PHOTOSPHERIC GRANULES AS A FUNCTION OF SOLAR ACTIVITY. C. Macris and D. Elias.
Ann. Astrophys., Vol. 18, No. 2, 143-4 (1955). In French.

From measurements of ten photographs of the solar disk, taken at irregular intervals between 1880 and 1943, an apparent relation is found between the number of granules on the total surface area of the visible disk, and the Wolf sunspot number, the number increasing from about 1.5×10^6 in a year of low sunspot number (about 5) to about 2.5×10^6 in a year of high sunspot number (about 100). D. R. Barber

523.743

13. THE POSSIBLE VARIATION OF PHOTOSPHERIC GRANULES. C.Macris.
Observatory, Vol. 75, 122-3 (June, 1955).

Observational data on the integrated area, photographic and visual contrast, and lifetimes of photospheric granules suggest a possible variation in phase with the 11 yr sunspot cycle. D.R.Barber

523.746

14. THE SUN'S ACTIVITY IN 1954. S. Cristaldi.
Mem. Soc. Astron. Ital., Vol. 26, No. 3, 297-307 (1955). In Italian.

The results deduced from the solar observations at the Catania Observatory are given for spots, faculae, prominences and chromosphere. Phenomena relating to the beginning of the new cycle of solar activity are particularly emphasized. A.

523.746

15. PRELIMINARY DETERMINATION OF THE MEAN DURATION OF THE 80-YEAR SUNSPOT CYCLE. W.Gleissberg.
Naturwissenschaften, Vol. 42, No. 14, 410 (1955). In German.

As the available time interval since Galileo's first observations of sunspots is too short for the utilization of the telescopic solar observations to derive a long-period cycle, the author makes use of the closely correlated aurorae phenomena. He analyses a still unpublished list by D.J.Schove which thus, on the basis of old chronicles of Northern Lights, provides the data of maximum solar activity back to 290 A.D. Altogether, during the last 16 centuries 20 long cycles become apparent. Each covers between 5 and 11 of the well-known short eleven-year cycles; the mean is 7.1 ± 0.3 cycles. Taking the mean length of the short cycles as 11.1 years, the tabulations indicate a variation of the long cycles between 75.5 and 82.1 years, with an average of 78.8 years. A.Beer

523.746

16. NOTE ON THE FORESHORTENING OF SUNSPOTS. M. Hotinli.
Rev. Fac. Sci. Univ. Istanbul C, Vol. 20, No. 1, 12-13 (Jan., 1955).

Answer to a criticism published by Kopecky and Mayer in Abstr. 5489 (1952).

523.746

17. THE IDENTIFICATION OF SUNSPOTS BY MEANS OF CHROMOSPHERIC FACULAE. M. d'Azambuja.
C.R. Acad. Sci. (Paris), Vol. 241, No. 7, 592-4 (Aug. 17, 1955). In French.

It is shown that the small, bright faculae (observed with the spectroheliograph in either H or K light) enable sunspots to be detected in the earliest stage of development. The faculae may precede the incipient spot-formation by from several hours up to as long as one or two days. D. R. Barber

523.746.5

18. A STUDY OF SHORT-PERIOD FLUCTUATIONS IN THE FREQUENCY OF SUNSPOTS. E. Balli.
Ann. Astrophys., Vol. 18, No. 2, 118-26 (1955). In French.

Using the independent statistical criteria of Gauss; Kermack and McKendrick (1937); and Gleissberg (1947), it is shown that the short-period fluctuations undergo a systematic variation whose period is seven to eight 11 yr cycles, i.e the Gleissberg 80 yr cycle. D. R. Barber

523.747

19. POLAR FACULAE. M. Waldmeier.
Z. Astrophys., Vol. 38, No. 1, 37-54 (1955). In German.

These were observed daily during 1951-54. The mean diameter of these flecks amounts to 2300 km, their life-time varies from a few minutes to several days. The mean heliographic latitude of the zone of polar faculae is about 66°, but shows a yearly variation corresponding to the inclination of the sun's axis. The polar zone is only an apparent one, produced by the visibility of the faculae. The visibility-function shows a broad maximum at distances between 55° and 70° from the centre of the sun's disk and drops strongly towards the sun's limb. In the polar caps, $b > 68°$, the density of the faculae is high and almost uniform, whereas in lower latitudes it becomes very much smaller. The region occupied by the polar faculae seems to be in close connection with the general magnetic field and the polar plumes of the solar corona. A.

523.77

20. THE SOLAR SPECTRUM BELOW 2000 ANGSTROMS. H. Friedman.
Ann. Geophys., Vol. 11, No. 2, 174-80 (1955).

Photon-counter measurements of the extreme ultraviolet and soft X-ray solar radiations have been made by rocket ascents to about 100 km during quiet solar conditions. The measured intensities of Lyman α-radiation, when plotted against equivalent air-path, fit a line based on an absorption coefficient of 0.046 cm^{-1} in agreement with Ditchburn's laboratory data ("Rocket exploration of the upper atmosphere", London: Pergamon Press, 1954). They impose an upper limit of 4500°K for the equivalent black-body temperature of the sun. The entire X-flux observed for three measured bands between 8 A and 100 A was about 0.05 $erg.cm^{-2}.sec.^{-1}$ with a distribution consistent with a computed coronal temperature of 750 000°K (Elwert, 1952). Determinations of the molecular O_2 distribution between 110 and 130 km suggest that at the latter height there exists in the upper atmosphere a much higher concentration of O_2 than would be expected from photochemical equilibrium. D.R.Barber

523.774

21. THE CENTRE–LIMB VARIATION OF THE WIDTH AND CENTRAL INTENSITY OF Hα, AND OF THE AREAS OF THE ERUPTIONS. A.Bruzek.
Z. Astrophys., Vol. 38, No. 1, 1-13 (1955). In German.

The results of this statistical investigation are: (1) The existing limb darkening is somewhat smaller than that of the neighbouring continuous spectrum. Qualitatively, this is explained through the absorption effect of cooler layers around or above the eruptions. (2) The effective line widths increase towards the limb; this effect is the more pronounced the larger the "true" width of the line at the centre of the disk, and can be traced to the effective optical thickness of the eruption, and to the limb-darkening of the continuous spectrum. The levels at which the eruptions start are the lower the greater the line width. (3) The areas of the eruptions increase with increasing distance from the centre of the disk. A.Beer

523.775

22. OBSERVATIONS OF PROMINENCES MADE AT THE KANDILLI-ISTANBUL OBSERVATORY IN 1954. M.Dizer.
Rev. Fac. Sci. Univ. Istanbul C, Vol. 20, No. 1, 1-7 (Jan. 1955). In French.

A continuation of visual spectroscopic data obtained with the 20 cm Zeiss equatorial, and commenced in 1950.
D.R.Barber

523.832

23. THE MEASUREMENT OF STELLAR RADIAL VELOCITIES WITH A NORMAL-FIELD OBJECTIVE PRISM. C.Fehrenbach and M.Duflot.
C.R. Acad. Sci. (Paris), Vol. 241, No. 9, 647-9 (Aug. 29, 1955). In French.

Results for 46 stars in Coma Berenices, of different spectral types, in the magnitude range 5.2 to 9.9. For method, and first results, see Abstr. 2672 (1948), 834 (1949).
D.R.Barber

523.852.22

24. THE He III – H II STRUCTURE IN PLANETARY NEBULAE. I. THE HYDROGEN–HELIUM MODEL. K.Eberlein.
Z. Astrophys., Vol. 38, No. 1, 14-36 (1955). In German.

Strömgren's theory of the H II – H I ionization layers of a hydrogen–helium model has been applied to a calculation of the structure of the He III – H II layers. An approximate numerical integration of the resulting system of non-linear differential equations shows that for a suitably chosen effective continuous absorption coefficient which depends on the excitation temperature T, the ratio of the radii of the He III to the H II ionization zones is smaller than 1 up to temperatures of 400 000°K, if the He abundance κ relative to hydrogen exceeds 0.1. The radii of these zones, their dependence on the stellar temperature T, the electron temperature T_ϵ, and the He abundance κ, are derived, as well as the density of this nebular model. A.Beer

523.852.3

25. PHOTOELECTRIC PHOTOMETRY OF EXTRAGALACTIC NEBULAE. J. H. Bigay and R. Dumont.
Ann. Astrophys., Vol. 18, No. 2, 141-2 (1955). In French.

A continuation of earlier work (Abstr. 7404/1953). Integrated magnitudes, and colour indices derived from measurements in blue and yellow light, have been obtained for 16 nebulae associated with the Perseus, Coma Berenice, and Virgo clusters. The results are in good agreement with those of Stebbins and Whitford (1948). D. R. Barber

523.872

26. EVALUATION OF STELLAR MONOCHROMATIC SURFACE BRIGHTNESSES AND TEMPERATURES. APPLICATION TO THE BRIGHT COMPONENT OF ALGOL. G. Cayrel-De Strobel, D. Chalonge and L. Divan.
Mem. Soc. Astron. Ital., Vol. 26, No. 3, 257-66 (1955). In Italian.

The necessary data are the colour temperature and the depth of the first Balmer lines. It is then easy to compute the apparent diameter of the star and also the centre-limb darkening of its disk for the various wavelengths of the continuum. The study of the bright component of Algol gives a test of the method. A.

523.877

27. ON STELLAR RADIATION. A. Martini and A. Masani.
Mem. Soc. Astron. Ital., Vol. 26, No. 3, 309-20 (1955). In Italian.

Starting from the formulae stated by Masani and Broglia the authors study the dependence of stellar radiation on electron pressure (as well as on the effective temperature). On the basis of this relation they explain the results of the observations of Chalonge and Divan and of Johnson and Morgan. A.

523.877

28. THE ROLE OF LINES FORMED BY DIFFUSION IN THE BLANKETING EFFECT. J.C.Pecker.
Ann. Astrophys., Vol. 18, No. 2, 145-6 (March-April, 1955). In French.

In a previous paper (Abstr. 7488/1951) the author asserted that lines formed by diffusion (i.e. absorption followed by immediate re-emission) do not play a significant part in the blanketing effect. This note is a justification of this assertion for isotropic diffusion. M.W.Ovenden

523.877

29. THE EARLY PHASES OF STELLAR EVOLUTION. L.G.Henyey, R.LeLevier and R.D.Levée
Publ. Astron. Soc. Pacific, Vol. 67, 154-61 (June, 1955).

Results of a theoretical investigation concerning the early life of a star; dealing with the pure gravitational contraction of a stellar configuration, and its transition to one deriving its energy from thermonuclear sources.
D.R.Barber

523.877 : 523.11

30. ON THE PROBLEM OF ROTATING COSMIC GASEOUS MASSES. K.U.v.Hagenow.
Z. Naturforsch., Vol. 10a, No. 8, 631-40 (1955). In German.

Weizsacker's equations (1948) are used to discuss the temporal evolution of a two-dimensional model with negligible initial central condensation and with initial density proportional to $\sqrt{\{1 - (s/s_1)^2\}}$, where s is distance from the axis of rotation. Radial velocities are regarded as small perturbation terms, and the gravitational potential at any stage is represented approximately as that due to a central condensation of mass M_0 together with a surrounding layer of gas in a state of rigid rotation. By assuming a suitable analytic form for the dependence of the mixing length on s and M_0, it is found possible to integrate the equations in closed form, and the growth of M_0 and the changes in mass density distribution with time are discussed. Applications to the origin of a star of solar mass and to the structure of M31 are considered.
R.A.Newing

523.877 : 539.17

31. THE NEUTRINO AND THE FORMATION OF TECHNETIUM IN CERTAIN STARS. E.Nahmias.
J. Phys. Radium, Vol. 16, No. 7, 49 S - 50 S (July, 1955). In French.

It is suggested that the technetium observed in the spectra of certain stars is formed by the inverse β reaction, $Ru^{99} + \tilde{\nu} \rightarrow \beta^+ + Tc^{99}$. J.M.Cassels

PHYSICS 53

53 : 371

32. OBSTACLES TO INCREASED PHYSICS ENROLLMENT. P.F.Brandwein.
Amer. J. Phys., Vol. 23, No. 8, 537-41 (Nov., 1955).

There is a continuing national need for trained physicists and citizens who understand the ways of the physicist and the nature of his contribution. This need can be met if physics teachers undertake to change teaching and curricular practice. One direction of the change which might be made is indicated. A.

53.081.1

33. HOW TO TRANSFORM M.K.S. EQUATIONS INTO THE GAUSSIAN SYSTEM. D.L.Matthews.
Amer. J. Phys., Vol. 23, No. 6, 385 (Sept., 1955).

FUNDAMENTALS 530.1

530.12

34. THE HISTORY OF THE THEORY OF RELATIVITY. L.Infeld.
Naturwissenschaften, Vol. 42, No. 15, 431-6 (1955). In German.

A brief review of Einstein's development of the special and general theories. R.A.Newing

530.12

35. UNIFIED REPRESENTATION OF THE ENERGY–MOMENTUM- AND SPIN TENSOR FOR ARBITRARY SPIN. H.J.Borchers.
Z. Phys., Vol. 141, No. 5, 571-84 (1955). In German.

It is shown that a general form for the energy–momentum tensor can be derived which is applicable to all cases of integer and half-integer spin, provided the field equations have been similarly formulated in the first place. G.Field

530.12

36. SUPERPOTENTIALS IN (JORDAN'S) EXTENDED THEORY OF GRAVITATION. K.Just.
Z. Phys., Vol. 142, No. 5, 493-502 (1955). In German.

Field equations are expressed in terms of "potentials" $U_{\alpha}^{\beta\lambda}$, which reduce to $g_{\alpha\kappa}\,(g^{\beta\kappa|\lambda} - g^{\lambda\kappa|\beta})\sqrt{-g}$ in the case of general relativity. The new formulation is illustrated by application to the author's equations for planetary motion (Abstr. 7669/1955). R.A.Newing

530.12

37. ON RELATIVISTIC KINEMATICS. Q.Majorana.
R.C. Accad. Naz. Lincei, Vol. 18, No. 5, 462-6 (March, 1955). In Italian.

530.12

38. HERTZ DIPOLE IN EXPANDING SPACE. K.Just.
Z. Phys., Vol. 142, No. 3, 266-76 (1955). In German.

An axially symmetric solution is obtained for the class of new field equations proposed by the author for Jordan's cosmology. The solution is interpreted as an oscillating dipole field and compared with corresponding results for the field equations of general relativity. R.A.Newing

530.12

39. ON THE REPRESENTATION OF THE UNIFIED FIELD BY A NON-SYMMETRIC TENSOR g_{ik}. J.Hély.
C.R. Acad. Sci. (Paris), Vol. 241, No. 9, 645-7 (Aug. 29, 1955). In French.

530.12

40. A NOTE ON THE STRENGTH OF FIELD EQUATIONS. F.E.Mauger.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 330-3 (Aug., 1955).

The notion of the "strength" of field equations introduced by Einstein in "The meaning of relativity" (4th ed., 1953) is used to compare Einstein's unified field equations with those given by Stephenson (Abstr. 10769/1954). The strength of Dirac's electrodynamics is also discussed and is found to be weaker than that of the classical Maxwell equations. R.A.Newing

530.12

41. RADIATIONS FROM A SPINNING ROD. D.Park.
Phys. Rev., Vol. 99, No. 4, 1324-5 (Aug. 15, 1955).

The angular distribution and total value of the power carried in the gravitational and electromagnetic radiations from a spinning rod are evaluated and compared. A.

530.12

42. GENERALIZED MAXWELL EQUATIONS IN (FANTAPPIÈ'S) DEFINITIVE RELATIVITY. G.Arcidiacono.
R.C. Accad. Naz. Lincei, Vol. 18, No. 5, 515-19 (March, 1955). In Italian.

See also Abstr. 7671 (1955). A bivector G_{ik} is defined at each point in 5-space, allowed transformations leaving invariant the quadratic form $-c^2t^2 + x_1^2 + x_2^2 + x_3^2 + R^2x_4^2$. The space-time components of G_{ik} are interpreted as e.m. intensities and the G_{i4} define a new 4-component "g" field. The 5-space analogues of the Maxwell equations are written down and expressed in 3-dimensional form. In the case of special relativity (x_4 = const.) the equations separate into the classical e.m. equations together with a group defining the "g" field. In the static case, the latter field is made up of a scalar field and a 3-vector field. R.A.Newing

530.12

43. CONSERVATION OF CHARGE IN EINSTEIN'S GENERALIZATION OF GRAVITATION THEORY. J.L.Anderson and P.Merat.
Phys. Rev., Vol. 99, No. 6, 1871-3 (Sept. 15, 1955).

The consequences of λ-invariance in Einstein's new modified field theory are investigated. It is shown that, as a consequence of this proposed invariance, it is possible to replace the antisymmetric part of the metric tensor with a four-potential. By further postulating invariance of the theory under a gauge transformation of the theory, it is possible to arrive at a quantity which can be interpreted as a current density four-vector. A.

530.12

44. GRAVITATIONAL RADIATION. J.N.Goldberg.
Phys. Rev., Vol. 99, No. 6, 1873-83 (Sept. 15, 1955).

The existence of gravitational radiation within the framework of the Einstein–Infeld–Hoffman (EIH) approximation method is investigated. Following a prescription introduced by Infeld, the radiation terms of the EIH expansion are begun with functions of the time alone. It is found that these terms do not have physical significance if they are introduced in the scalar or longitudinal components of the gravitational potentials. However, if the radiation terms are introduced in the fifth order of the transverse-transverse components, one finds a contribution to the curvature tensor in the seventh order, a contribution to the equations of motion in the ninth

order, and radiation in the tenth order. The existence of radiation is determined by calculating the energy passing through a spherical surface which is an infinite distance from all source points. This definition of radiation agrees with that used in the theory of electromagnetism. A.

530.12

45. GRAVITATIONAL RADIATION. A.E.Scheidegger. Phys. Rev., Vol. 99, No. 6, 1883-5 (Sept. 15, 1955).

Recently, several solutions of the field equations of general relativity theory have been published which are based upon the EIH approximation method and claim to represent radiative effects in the motion of freely gravitating particles. These solutions are analysed and it is shown that none produced to date represents a satisfactory discussion of the possibility of radiation by freely gravitating particles. The problem of the possibility of gravitational radiation by free particles is then investigated upon general grounds. It is shown that the possibility of such radiation depends on the definition of free particles. This definition depends on the (unproven) assumption that the EIH method is, in its physical outcome, independent of the coordinate system. If this assumption were not true, this would constitute a severe limitation of the method and imply that all results have to be expressed in a standard coordinate system. Under these circumstances, the definition of free particles is obviously equivalent to a postulate of absence of radiation. A.

530.12

46. LORENTZ TRANSFORMATION AND THE THOMAS PRECESSION. W.H.Furry. Amer. J. Phys., Vol. 23, No. 8, 517-25 (Nov., 1955).

The various kinematic effects of special relativity are here treated by considering iterations of the infinitesimal Lorentz transformation. There is only one relativistic effect that appears as a difference between an infinitesimal Lorentz transformation and the corresponding infinitesimal Galilei transformation; this effect is the relative character of simultaneity. When this has been introduced by a physical argument (following Einstein), finite transformations and the other effects are obtained by iteration. Special attention is given to an iteration procedure that reveals the existence of the Thomas precession. A.

530.12

47. NEW GEOMETRIC REPRESENTATION OF THE LORENTZ TRANSFORMATION. H.Amar. Amer. J. Phys., Vol. 23, No. 8, 487-9 (Nov., 1955).

Most geometric representations of the Lorentz transformation use either imaginary angles or imaginary space-time coordinates. A new and simple representation is proposed using only real coordinates and real angles, and allowing a graphical illustration of the major features of the Lorentz transformation. A.

530.12

48. SPINOR THEORY AND RELATIVITY. I. W.T.Payne. Amer. J. Phys., Vol. 23, No. 8, 526-36 (Nov., 1955).

The elementary properties of relativistic spinors of first rank are developed geometrically, on the basis of the idea that the space in which they reside is either the positive or the negative branch of the light cone. As an aid in the development, the Lorentz transformations of points on the light cone are first studied in considerable detail. A.

530.145

49. ALBERT EINSTEIN AND THE LIGHT QUANTUM. M.Born. Naturwissenschaften, Vol. 42, No. 15, 425-31 (1955). In German.

A survey of Einstein's contributions to quantum theory. R.A.Newing

530.145

50. FOUNDATIONS OF QUANTUM THEORY. A.Lande. London: Oxford University Press; New Haven: Yale University Press (1955) 168 pp.

"This study in continuity and symmetry aspires to be a systematic deduction of the concepts and formal rules of the quantum theory from fundamental and almost self-evident postulates."

530.145

51. ON PRODUCTS OF QUANTITIES AS DISTRIBUTIONS. K.Gotô. Progr. theor. Phys., Vol. 13, No. 1, 112-14 (Jan., 1955).

A contribution to recent work on the application of the Schwartz theory of distributions to some of the problems of singularities in quantum field theory. Two products of integrals of distributions are now defined and some properties of these are established. L.S.Goddard

530.145

52. ON THE PROOFS OF "BACKWARD" UNIQUENESS FOR SOME NON-CONSERVATIVE FIELDS DESCRIBABLE BY DIFFERENTIAL EQUATIONS OF THE HYPERBOLIC TYPE. A.Trautman. Bull. Acad. Polon. Sci. Cl. 3, Vol. 3, No. 6, 307-12 (1955).

The theorems of Plebański (Abstr. 6262/1954) are extended so that e.g. it can be deduced that there exists at most one electromagnetic field in a certain set of points in a 4-dimensional continuum Ω, and satisfying prescribed values in a bounded region R. W.J.Swiatecki

530.145

53. POTENTIAL IN QUANTUM FIELD THEORY. T.Imamura. Progr. theor. Phys., Vol. 13, No. 2, 183-8 (Feb., 1955).

From Green function theory, the integral equation for the R-matrix can be written in a form similar to that found by using the phenomenological potential. Comparing these two equations with each other, an integral equation for the potential is obtained. This equation takes a very relevant form, all divergent parts being written in a covariant way. A.

530.145

54. TEMPORALLY ORDERED GRAPHS AND BOUND. STATE EQUATIONS. J. C. Polkinghorne. Proc. Cambridge Phil. Soc., Vol. 51, Pt 4, 762-5 (Oct., 1955).

Ordered graphs are used to obtain the kernels of the single-time, three dimensional, equations for bound states given by Lévy and Klein, and by Tamm and Dancoff. A.

530.145

55. AN EXAMPLE OF FIVE-DIMENSIONAL FIELD. T.Yamamoto. Progr. theor. Phys., Vol. 13, No. 2, 217-18 (Feb., 1955).

Five-dimensional equations of motion for fermion and boson fields are written down and energy eigenvalues are deduced for the fermion field. The Lagrangian density for a boson field is given and an interaction Lagrangian is assumed. G.Field

530.145

56. ON THE CONSISTENCY OF THE QUANTUM FIELD THEORY BASED ON THE RENORMALIZATION HYPOTHESIS. T.Yoshimura. Progr. theor. Phys., Vol. 13, No. 2, 220-2 (Feb., 1955).

It is claimed that perturbation theory is not valid in the high-energy region even after renormalization, and that the classification of interactions according to renormalizability has no meaning apart from perturbation theory. P.T.Matthews

530.145

57. STRUCTURE OF GREEN'S FUNCTIONS IN QUANTUM FIELD THEORY. Y.Nambu.
Phys. Rev., Vol. 100, No. 1, 394-411 (Oct. 1, 1955).

The Green's functions are vacuum expectation values of time-ordered products of field operators in the Heisenberg representation. They give vital information about the nature of the interacting particles and quanta represented by these field operators. It is shown that the Fourier transforms of the Green's functions (for up to four operators) are expressible as parametric integrals involving invariant energy denominators and real, scalar weight functions which are termed the spectral functions. Relativity, causality, and some other fundamental assumptions of field theory are required to derive the result. The spectral functions have a simple physical interpretation, and completely specify the structure of the Green's functions. The equations of motion which hold between Green's functions of different order can be translated into the corresponding relations between the spectral functions. Renormalization can be carried out explicitly, bringing the equations for the spectral functions into a manifestly renormalized form. The causality condition also serves as a means of obtaining renormalized quantities without recourse to the usual subtraction procedure. The observed masses and coupling constants occur in the equations for the spectral functions as external parameters fixing the boundary condition. No unobservable bare masses and couplings, nor the (infinite) renormalization constants ever appear in the equations. These quantities, however, are shown to be expressible in terms of the spectral functions. The Green's functions involving more than four field operators are not considered. A.

530.145

58. QUANTUM THEORY OF ELECTROMAGNETIC RADIATION IN DIELECTRICS. K.Nagy.
Acta phys. Hungar., Vol. 5, No. 1, 95-118 (1955). In German.

The energy and momentum eigenvalues of the electromagnetic field are determined for a coordinate system in which the dielectric has velocity v along the x-axis. For a description of the dynamical properties of the radiation field, the radiation energy-momentum tensor is used, which contains the interaction between the field and the dielectric. After obtaining corresponding eigenvalues for a moving coordinate system, the time dependence of the operators is derived, and the transformation properties of the photon energy and momentum are discussed. It is shown that, in general, the photon energy in moving dielectrics is not $h\nu$, and that the photon rest energy and rest mass take finite, positive, non-zero values. G.Field

530.145

59. ON SOME GENERAL RELATIONS IN QUANTUM ELECTRODYNAMICS. E.S.Fradkin.
Zh. éksper. teor. Fiz., Vol. 29, No. 2(8) 258-61 (1955). In Russian.

General relations connected with the gauge invariance relating the Green's function and vertex parts are given. G.E.Brown

530.145

60. GAUGE-INVARIANT FORMULATION OF QUANTUM ELECTRODYNAMICS. P.A.M.Dirac.
Canad. J. Phys., Vol. 33, No. 11, 650-60 (Nov., 1955).

Electrodynamics is formulated so as to be manifestly invariant under general gauge transformations, through being built up entirely in terms of gauge-invariant dynamical variables. The quantization of the theory can be carried out by the usual rules and meets with the usual difficulties. It is found that the gauge-invariant operation of creation of an electron involves the simultaneous creation of an electron and of the Coulomb field around it. The requirement of manifest gauge invariance prevents one from using the concept of an electron separated from its Coulomb field. A.

530.145

61. ON THE INTERACTION OF V-PARTICLES. S.Iwao.
Progr. theor. Phys., Vol. 13, No. 1, 111-12 (Jan., 1955).

θ particles are assumed to be scalar and directly coupled to Λ's and nucleons. The strength of this coupling is estimated, by perturbation theory, from the pair production of θ^0 and Λ^0, and the binding energy of Λ^0 in ${}^4H_1^3$ to be $g^2/4\pi \simeq 1$. P. T. Matthews

530.145 : 539.18

62. ON FLUCTUATIONS IN COLLISIONS OF PARTICLES OF HIGH ENERGY. M.I.Podgoretskiĭ, I.L.Rozental' and D.S.Chernavskiĭ.
Zh. éksper. teor. Fiz., Vol. 29, No. 3 (9), 296-303 (1955). In Russian.

On the basis of the Landau–Fermi statistical theory of production of particles in high-energy collisions, fluctuations in the number of particles and in the energies carried off by the particles are calculated. G.E.Brown

530.145 : 539.18

63. ON THE DISTRIBUTION OF PARTICLES WITH ENERGY IN MULTIPLE PRODUCTION. N.M.Gerasimova and D.S.Chernavskiĭ.
Zh. éksper. teor. Fiz., Vol. 29, No. 3 (9), 372-4 (1955). In Russian.

In Landau's hydrodynamical modification of Fermi's theory of multiple production, the part of the solution describing a travelling wave has been left out. Effects of this wave are calculated here and it is found that it can carry away an appreciable fraction of the energy. G.E.Brown

530.145

64. MANY-BODY PROBLEM FOR STRONGLY INTERACTING PARTICLES. II. LINKED CLUSTER EXPANSION. K.A.Brueckner.
Phys. Rev., Vol. 100, No. 1, 36-45 (Oct. 1, 1955).

An approximation method developed previously (Abstr. 3451/1955) to deal with many particles in strong interaction is examined in further detail. It is shown that the series giving the interaction energy is a development in a sequence of linked or irreducible cluster terms each of which gives a contribution to the energy proportional to the total number of particles. Consequently the convergence of the expansion is independent of the total number of particles. The origin of this simple feature is illustrated by showing that a similar situation exists in the expansion of standard perturbation theory. The numerical convergence of the expansion is quantitatively discussed for the nuclear problem where it is shown that the correction arising from the first cluster term involving three particles is less than the leading term by a factor of about 10^{-4}. The smallness of the correction is largely a result of the action of the exclusion principle. A.

530.145

65. CROSS SECTIONS IN DEUTERIUM AT HIGH ENERGIES. R.J.Glauber.
Phys. Rev., Vol. 100, No. 1, 242-8 (Oct. 1, 1955).

Recent measurements at high energies indicate that the total cross-sections for collisions of both nucleons and π-mesons with deuterons are noticeably smaller than the sums of the corresponding cross-sections for free neutrons and protons. A formalism for calculating the cross-sections of the deuteron is developed, based on the assumption that the interactions of the incident particle with the neutron and proton may individually be treated by the general methods of diffraction theory. The nonadditivity of the free-particle cross-sections is shown to be due largely to "eclipses" in which either the neutron or the proton lies in the shadow cast by the other, an effect in which quantum mechanical diffraction plays an impor-

tant role. Simple representations of the high-energy interactions and the ground-state wave-function of the deuteron are found to lead to cross-section defects of the magnitude observed. A.

530.145

66. SOME NOTES ON NONRENORMALIZABLE FIELD THEORY. L.N.Cooper.
Phys. Rev., Vol. 100, No. 1, 362-70 (Oct. 1, 1955).

Some nonrecoil, derivative coupling theories, which are exactly soluble, are analysed in order to discover what it is that produces the nonrenormalizable behaviour typical of derivative coupling. This behaviour is found to arise as the result of an essential singularity which the operators of the derivative theories possess at the origin in coordinate space and the resulting branch point the Fourier transforms of these operators possess at the origin in the complex coupling constant domain. This branch point causes the breakdown of the expansion of the Fourier transform of the operators in powers of the coupling constant and introduces the renormalizable infinities. It is shown that a coordinate space coupling constant expansion is possible, and that a Fourier transform of the operators of the derivative theories may be defined by analytic continuations and made finite by renormalization. A.

530.145

67. TENSORS, CHARACTERIZED BY TWO REAL SPINORS. G.A.Zaĭtsev.
Zh. éksper. teor. Fiz., Vol. 29, No. 2(8) 166-75 (1955). In Russian.

Tensors whose components can be expressed through components of real spinors are studied. Transformation properties under spinor transformations of the first and second types are considered. G.E.Brown

530.145

68. ON THE QUESTION OF INTERPRETATION OF DIRAC'S EQUATION FOR THE ELECTRON. G.A.Zaĭtsév.
Zh. eksper. teor. Fiz., Vol. 29, No.2(8) 176-80 (1955). In Russian.

Dirac's equation is expressed as a pair of equations on real spinors. Transformation properties of the spinors and operators are studied. G.E.Brown

530.145

69. THE GREEN'S FUNCTIONS FOR EQUATIONS OF PARTICLES OF ARBITRARY SPIN. K.K.Gupta.
Proc. Indian Acad. Sci. A, Vol. 41, No. 6, 231-8 (June, 1955)

Expressions are derived for the Green's function for the Bhabha equation (Abstr. 56/1950) and for the Feynman S_F function. G.Field

530.145

70. ON THE MOTION OF A FINITE ELECTRON AND THE CORRESPONDENCE WITH THE POINT ELECTRON OF CLASSICAL RELATIVISTIC MECHANICS. E.Bellomo.
Nuovo Cimento (Ser. 10), Vol. 2, No. 3, 456-66 (Sept., 1955). In Italian.

The equations of motion are derived for an extended model which is rigid in the sense of Born's relativistic definition of rigidity. Agreement with Dirac electrodynamics follows in the limiting case of a point electron. Non-physical solutions occur for models whose radii are smaller than the classical electron radius. R.A.Newing

530.145

71. ELEMENTARY PARTICLES AS SELF-MAINTAINED EXCITATIONS. F.A.Kaempffer.
Phys. Rev., Vol. 99, No. 5, 1614-15 (Sept. 1, 1955).

A model is suggested which might overcome the difficulties of divergence and produce a mass spectrum. Starting with interacting radiation and neutrino fields, the Lagrangian and field equations are set up. Different types of solutions would give rise to different masses. G.Field

530.145

72. A THEORY OF NEW PARTICLES. R.Utiyama.
Phys. Rev., Vol. 100, No. 1, 248-54 (Oct. 1, 1955).

A tentative scheme is developed to formulate the behaviour of the new unstable particles. This scheme is a straightforward generalization of the usual charge-independent meson theory. The selection rules for isotopic spin are identical with those suggested by Gell-Mann. Owing to the particular form of the interaction assumed in this scheme, a new selection rule can be derived which seems to be of some use in interpreting the metastability of the new particles. A.

530.145

73. INTERNAL STRUCTURE OF SPINNING PARTICLES. D.Finkelstein.
Phys. Rev., Vol. 100, No. 3, 924-31 (Nov. 1, 1955).

Elementary particle models with internal degrees of freedom have been investigated within the framework of special relativity and orthodox quantum mechanics. Classical arguments indicate that systems whose extensions are less than about their Compton wavelength have spin excitation energies greater than about their rest mass. The principal aim of this paper is enumeration and classification of particles with rigid internal structure and a useful classification of particle models is by their symmetry groups. In nonrelativistic mechanics this classification shows that there are only the three well-known types of rigid systems that might be labelled by number of degrees of freedom as [0], [2] and [3] and are exemplified by an ideal point, diatomic molecule and rotator, respectively; while of the three types, but one, [3], possesses a spin-$\frac{1}{2}$ state of the Pauli-electron type. The corresponding analysis for relativistic mechanics shows there are nine types labelled here [0], [2], [3], [3'], [4], [4'], [4''], [5] and [6], and in addition two one-parameter infinities of types $[3_f]$ and $[5_f]$ $(0 \leq f \leq \pi)$. An algorithm exists for obtaining the spin-spectra of rigid structures from their symmetry groups. Of the $9 + 2\infty$ types, just three ([4], [5] and [6]) possess spin-$\frac{1}{2}$ states of the Dirac-electron type. The apparent rest-mass depends upon the internal rotational state of the particle, as is shown by an unrealistic example of a Lagrangian which is an extension of that of the Klein–Gordon particle. A.

530.145

74. ON THE FIVE-DIMENSIONAL THEORY OF NUCLEAR INTERACTION AND A NEW SOLUTION OF THE DIPOLE DIFFICULTY. N.S.Kalitsin.
C.R. Acad. Bulg. Sci., Vol. 7, No. 3, 1-5 (Oct.-Dec., 1954). In Russian.

Equations for a 5-dimensional meson field are derived and applied to calculate the $e^{-\omega r}/r$ and $e^{-\omega r}/r^2$ terms in the interaction potential of two nucleons. The $e^{-\omega r}/r^3$ term can be eliminated by a suitable choice of interaction constants. W.J.Swiatecki

530.145

75. MOTION OF DIRAC PARTICLES IN MESON FIELDS. G.Györgyi.
Acta phys. Hungar., Vol. 5, No. 1, 119-22 (1955). In German.

The operator equations of motion are discussed for a single Dirac particle in a pseudoscalar meson field, with pseudoscalar and pseudovector couplings. For pseudoscalar coupling a relativistic short-range potential is obtained which is repulsive. G.Field

530.145

76. A NOTE ON THE DAMPING OF PAIR FORMATION IN PSEUDOSCALAR MESON THEORY. T.Hamada and Y.Shôno.
Progr. theor. Phys., Vol. 13, No. 1, 102-3 (Jan, 1955).

The corrections to the nucleon propagator due to graphs

containing two virtual mesons almost cancel the damping effects derived by Brueckner et al. (Abstr. 4613/1953).
G.Field

530.145

77. RECOIL CORRECTION TO THE ADIABATIC NUCLEAR POTENTIAL. M.Shindo and K.Nishijima.
Progr. theor. Phys., Vol. 13, No. 1, 103-5 (Jan., 1955).
Continuation of previous work (Abstr. 52/1953). The recoil correction is considered to fourth order in the coupling constant for symmetric pseudoscalar theory with derivative coupling. The sign of the spin–orbit coupling term obtained is opposite to that required by the shell model. G.Field

530.145

78. ON THE EQUIVALENCE THEOREM. Y.Takahashi.
Progr. theor. Phys., Vol. 13, No. 1, 105-6 (Jan., 1955).
Further discussion of the matrix elements for $\pi^0 - 2\gamma$ (see Abstr. 10783/1954), in particular of (1) the terms which are non-gauge-invariant, and (2) those which violate the equivalence of pseudoscalar and pseudovector coupling in pseudoscalar theory. G.Field

530.145

79. NONADIABATIC TREATMENT OF NUCLEAR FORCES. I. STATIC LIMIT. J.Iwadare.
Progr. theor. Phys., Vol. 13, No. 2, 189-99 (Feb., 1955).
A method of the canonical transformation is applied to the problem of nuclear forces. Here the nucleon field as well as the meson field is quantized. Expressions for potentials which do not contain the total energy of the system can be obtained explicitly. The 2nd- and 4th-order potentials are evaluated in Ps(ps) meson theory. The practical calculations are performed up to the order $(\mu/2M)^4$ for the one- and the two- pair terms, and up to the order $(\mu/2M)^5$ for the no-pair terms in the static limit $p/M \to 0$. The results are in agreement with Klein's calculation. A.

530.145

80. THE D-WAVE CONTRIBUTION TO PION–NUCLEON SCATTERING. T. Yamanouchi and N. Fukuda.
Progr. theor. Phys., Vol. 13, No. 2, 200-4 (Feb., 1955).
The D-wave phase shifts of pion–nucleon scattering are calculated by covariant perturbation theory, up to 4th-order in the coupling constant, adopting the symmetrical pseudoscalar meson theory with pseudoscalar coupling. It is shown that the 2nd-order calculation gives at most two degrees at 200 MeV as D-phase shifts, and that the 4th-order contribution can almost be neglected. This result seems to be consistent with the experimental analysis by Glicksman at 217 MeV. A.

530.145

81. NON-STATIC CORRECTIONS TO THE FOURTH ORDER NUCLEAR FORCES. J.Iwadare.
Progr. theor. Phys., Vol. 13, No. 2, 218-19 (Feb., 1955).
Terms of fourth order in the ratio of meson to nucleon masses (and fifth order for no-pair terms) are listed for pseudoscalar theory with pseudoscalar coupling. They include velocity-independent terms and spin-orbit forces. G.Field

530.145

82. WARD'S IDENTITY IN NEUTRAL SCALAR MESON–NUCLEON SYSTEM. K.Hiida and S.Machida.
Progr. theor. Phys., Vol. 13, No. 2, 219-20 (Feb., 1955).
A type of Ward identity is established for this interaction.
P.T.Matthews

530.145

83. MOMENTUM DEPENDENCE OF PHASE SHIFTS. C.J.Goebel, R.Karplus and M.A.Ruderman.
Phys. Rev., Vol. 100, No. 1, 240-1 (Oct. 1, 1955).
A lower limit is found for the momentum derivative of the scattering phase-shifts of a relativistic neutral two-particle system when the interaction is of finite range. A.

530.145

84. RENORMALIZATION OF MESON PAIR THEORY. W. Thirring.
Helv. phys. Acta, Vol. 28, No. 4, 344-5 (1955). In German.
It is not possible to develop a consistent renormalized meson pair theory, in the limit of the source radius going to zero. Since Lee's model (Abstr. 9936/1954) leads to similar difficulties, it is suggested that there are always inconsistencies in any theory in which the ratio of the renormalized to the unrenormalized coupling constant is infinite.
P. T. Matthews

530.145

85. RENORMALIZATION OF DERIVATIVE COUPLING THEORIES. R.Arnowitt and S.Deser.
Phys. Rev., Vol. 100, No. 1, 349-61 (Oct. 1, 1955).
The method of functional integrals is applied to the problem of meson theories with derivative couplings. In the static limit, solutions in closed form can be exhibited. The infinities occurring in the theory are found to be removable in terms of Z_2 and mass renormalizations, contrary to the conclusions of perturbation analysis. The divergences occurring here have the form of essential singularities, in contradistinction to the branch-point behaviour of the usual "renormalizable" theories. The lack of validity of the perturbation expansion is thereby accounted for. These techniques can be extended to treat the full recoil neutral ps(pv) problem omitting closed loops. The theory is represented in terms of an exponential coupling which permits a nonperturbation series solution for the various propagators. Two infinite renormalizations are again required. The resultant functions are given meaning by analytic continuation procedures which are adapted to the four-dimensional nature of the problem. The form of the effective coupling suggests a rearrangement of the answer in terms of exponentials of the meson propagator. As a result mass operator-like structures can be defined. These explicitly exhibit the transcendental nature of the coupling and generalized equivalence theorems with ps(ps) theory can be generated. In a similar fashion, effective interaction operators for the two-nucleon and meson-nucleon Green's functions are derived. The possible applicability of these quantities to questions of physical interest such as nuclear potentials and multiple meson production is briefly mentioned. In an appendix, a model of beta coupling is discussed in connection with the renormalization question there. A.

530.145

86. EXTENDED ISOTOPIC SPIN INVARIANCE AND MESON-NUCLEON COUPLING. S.A.Bludman.
Phys. Rev., Vol. 100, No. 1, 372-5 (Oct. 1, 1955).
The identities derived from a Lagrangian density that is invariant under transformations that depend on arbitrary functions are used to develop the restrictions on allowed forms of coupling that follow from assuming extended isotopic spin invariance. A proof is given that invariance under local isotopic spin rotations is not possible for pions and nucleons alone. The relations between the transformation law and the invariant Lagrangian are developed if (a) the pion-nucleon system is allowed to admit a more general extended isotopic spin group, or (b) additional fields are admitted in order to maintain the local isotopic spin rotational invariance. In either case, definite restrictions on the permissible transformation properties for the field quantities are obtained if pion-nucleon isotopic spin conservation is to be maintained. A.

530.145

87. CONNECTION BETWEEN THE S-MATRIX AND THE TENSOR FORCE. R.G.Newton.
Phys. Rev., Vol. 100, No. 1, 412-28 (Oct. 1, 1955).

This is a study of the radial Schrödinger equations for the case of an interaction between the lth and the (l + 2)nd angular momentum, produced by the tensor force in the presence of spin-orbit coupling. It contains a number of theorems, known for central potentials, concerning the low-energy behaviour of the S-matrix, bound states, and zero-energy resonance. The construction, in two stages, of all potentials belonging to a given S-matrix and given bound states, is described. The step from the spectral function to the potential involves the generalization of the Gel'fand Levitan equation given in a previous paper (Abstr. 5223/1955); that from the S-matrix to the spectral function, a procedure due to Plemelj also outlined in that paper. The latter procedure leads to a restriction on the S-matrix necessary for a short range potential to exist. If there is such a potential, it is uniquely determined by the S-matrix, the binding energies, and as many real, symmetric, positive semidefinite matrices as there are bound states. A.

530.145

88. ON THE QUANTUM MECHANICS OF MANY-BODY PROBLEMS, G.Falk.
Z. Phys., Vol. 142, No. 3, 297-309 (1955). In German.

A number of theorems are proved concerning the quantum mechanics of systems consisting of compound particles. The results are applied to the collision of H_2 molecules and the algebraic methods are used to sketch a reformulation of quantum mechanics. R.O.Davies

530.145

89. ON THE STRUCTURE OF DIRAC WAVE FUNCTION. T.Takabayasi.
Progr. theor. Phys., Vol. 13, No. 1, 106-8 (Jan., 1955).

The 16 bilinear quantities $\psi^* \gamma^a \psi$ are arranged as the elements of a square matrix and this representation is used to give a simultaneous derivation of the 9 quadratic identities. R.A.Newing

530.145

90. WAVE EQUATIONS IN CONFORMAL SPACE — WAVE EQUATION FOR NUCLEON. Y.Murai.
Progr. theor. Phys., Vol. 13, No. 1, 109-10 (Jan., 1955).

It is stated that any wave equation can be described in a conformally invariant manner in 5-dimensional projective space corresponding to an assembly of hyperspheres in Minkowski space-time. The second order wave equation reduces to a wave equation with a mass term in 4-space. Linearization gives an 8-component wave equation. R.A.Newing

530.145

91. ON CONFIGURATIONAL WAVE-FUNCTIONS IN THE THEORY OF FIELDS. P.Bocchieri and A.Loinger.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 380-2 (Aug., 1955). In Italian.

Proposes that the abstract state vector describing the state of interacting fermion and boson fields be expanded in terms of the free fermion field alone, thus obtaining wave-functions which are still abstract vectors with respect to the boson field. The case of electrodynamics is studied briefly as an illustration of this approach. J.M.Radcliffe

530.145

92. A SIMPLE EXAMPLE (DRAWN) FROM STOCHASTIC QUANTUM MECHANICS. F.Bopp.
Z. Phys., Vol. 143, No. 2, 233-8 (1955). In German.

Retaining the view that there are no stochastic equations which are fully equivalent to those of quantum mechanics (absence of hidden parameters), the author proceeds to show by example that there are, however, stochastic equations, which do not differ noticeably from quantum mechanical ones (within experimentally verifiable ranges). P.T.Landsberg

530.145 : 530.162

93. WAVE MECHANICAL TREATMENT OF THE FERMI GAS. W.Macke.
Phys. Rev., Vol. 100, No. 4, 992-3 (Nov. 15, 1955).

A wave mechanical treatment of a Fermi gas is described using a generalized Ritz method, which gives in a zero approximation the well-known energy terms of Thomas-Fermi, Weizäcker and Gombas and which can be refined to any desired degree. A.

530.145 : 530.162

94. THE STATISTICAL INTERPRETATION OF QUANTUM MECHANICS (NOBEL LECTURE, 1954). M.Born.
J. Phys. Radium, Vol. 16, No. 10, 737-43 (Oct., 1955). In French. Translation in Science, Vol. 122, 675-9 (Oct., 14, 1955).

A history of quantum mechanics in the years 1920—1928, with discussion of some philosophical problems raised by the quantum theory.

530.162

95. FOUNDATIONS OF STATISTICAL MECHANICS. D.ter Haar.
Rev. mod. Phys., Vol. 27, No. 3, 289-338 (July, 1955).

A detailed review of the status of the H-theorem and the ergodic theorem in both classical and quantum statistical mechanics. 283 references. E.H.Sondheimer

530.162

96. STATISTICAL DYNAMICS OF MULTIPLY PERIODIC SYSTEMS. M.Born and D.J.Hooton.
Z. Phys., Vol. 142, No. 2, 201-17 (1955). In German.

The physically unrealistic assumption of completely determined initial conditions in classical mechanics is replaced by the introduction of a localized density in phase space, which satisfies Lionville's equation. It is shown that an initial uncertainty spreads in such a way in phase space that all states which conform to the initial values of the constants of the motion become equally likely. This applies to an arbitrary number of degrees of freedom (including one) and is not a consequence of ignorance associated with a large number of particles. The main difference between classicial and quantum mechanics is not the necessity of a statistical interpretation but the introduction of the probability amplitude. It is noteworthy that in classical mechanics the product of the uncertainties of a pair of suitable variables is a constant, though not a universal constant as in quantum mechanics. F.Ansbacher

530.162

97. STATISTICAL PHYSICS AND ITS PROBLEMS. C.Domb.
Sci. Progr., Vol. 43, 402-17 (July, 1955).

A non-specialist article (based on an inaugural lecture) dealing mainly with the statistical mechanics of interacting particles. R.O.Davies

530.162 : 536.7

98. ON THE STATISTICS OF A FERMI–DIRAC GAS IN INTERACTION WITH A BOSE–EINSTEIN GAS. F.Kaschluhn.
Ann. Phys. (Leipzig), Vol. 16, No. 5-8, 257-86 (1955). In German.

The thermodynamical behaviour of a system of coupled fields is investigated, using the idea of a grand canonical ensemble. A scalar field of a fixed number of fermions interacts with a vector Bose field in which bosons can be created and annihilated. A weak-coupling approximation is used to obtain expressions for the mean occupation numbers of fermions and bosons in given states and the mean square fluctuations of energy, total number of particles and occupation numbers. The specific heat near absolute zero temperature is calculated to first order. G.Field

GENERAL MECHANICS
MECHANICS OF SOLIDS 531

531.3

99. A SIMPLE MECHANICS PROBLEM. F. J. Milford.
Amer. J. Phys., Vol. 23, No. 6, 385-6 (Sept., 1955).

The mathematical expression of the oscillatory motion of a mass attached to a spring and sliding along an inclined plane is discussed in order to illustrate the correct form of the potential energy to be used in the application of small oscillation and Lagrangian techniques to spring problems.

S. Weintroub

531.51

100. DEDUCTION OF NEWTON'S LAW OF GRAVITATION FROM THE PROPERTY OF THE GALILEAN GROUP. II. L. Fantappiè.
R.C. Accad. Naz. Lincei, Vol. 18, No. 5, 458-61 (March, 1955). In Italian.

In completing the previous investigation (Pt I, Abstr. 7719/1955) it is shown that the law of interaction determined by Galilean transformations is actually of the classical Newtonian form. R.A.Newing

531.577 : 539.61

101. SURFACE FRICTION IN BALLISTIC PENETRATION. J.M.Krafft.
J. appl. Phys., Vol. 26, No. 10, 1248-54 (Oct., 1955).

The frictional adhesion between projectile and target during a ballistic penetration has been measured with a torsion-type Hopkinson bar. The apparatus allows measurement of the torsional adhesion of a spinning projectile during target penetration. By assuming the friction resisting rotation to be equal to that resisting axial penetration, the energy loss due to friction was computed. The results show that the torque-time pattern during penetration of a "mechanically" clean projectile can be predicted with the assumption of a frictional energy loss just sufficient to keep the sliding surfaces at the melting temperature of the metal. Metallographic analysis of the target metal at the projectile interface gives a further indication of a molten interface. In these tests, sliding friction accounts for about 3% of the striking energy of the projectile; common surface contaminants, not necessarily special lubricants, reduce this loss to less than 1%. A.

531.61

102. A SECOND PARALLEL AXIS THEOREM FOR ANGULAR MOMENTUM. M. A. Melvin.
Amer. J. Phys., Vol. 23, No. 2, 125 (Feb., 1955).

Viewed in a properly translating frame, the state of motion at any instant of a body of mass M is that of pure rotation about an instantaneous axis O. On the perpendicular to O through the mass centre, extended beyond the latter, lies the instantaneous centre of percussion P. The normal plane through P is defined to be the "plane of percussion". The following theorem is then proved: The angular momentum L' about any axis O' parallel to the instantaneous axis is equal to the angular momentum about O' of a particle of mass M moving parallel with the mass centre, but in the plane of percussion. A corollary of this theorem is: The angular momenta L' and L'' about two axes parallel to the instantaneous axis are proportional to the respective distances r' and r'' of these axes from the plane of percussion. A.

MECHANICAL MEASUREMENTS 531.7

531.754.5 : 548.57

103. PRECISION DENSITY DETERMINATION OF LARGE SINGLE CRYSTALS BY HYDROSTATIC WEIGHING. A.Smakula and V.Sils.
Phys. Rev., Vol. 99, No. 6, 1744-6 (Sept. 15, 1955).

In connection with a study of crystal imperfections, the density of Si, quartz, CaF_2, CsI, Ge, TlCl, TlBr and polycrystalline Al have been determined by an hydrostatic weighing method using ethylene bromide as the immersion liquid. Random and systematic errors are discussed, and accuracy of the order of 10^{-5} reached. A.

531.76 : 529.7

104. AN ATOMIC STANDARD OF FREQUENCY AND TIME INTERVAL.
Nature (London), Vol. 176, 280-2 (Aug. 13, 1955).

A CAESIUM RESONATOR. L. Essen and J. V. L. Parry (280-2).

Description of a frequency standard built at the N. P. L. which uses a natural resonant frequency of the caesium atom. The accuracy claimed at present (1 part in 10^9) is likely to be improved, and represents the highest ever achieved in the measurement of any physical quantity in terms of a definite standard.

DEFINITION OF THE SECOND OF TIME. E. C. Bullard (282).

In view of the increasing laboratory accuracy of time measurement it is suggested that the astronomically defined second (of Ephemeris Time) should be abandoned for the most refined physical measurements. Comparison of times shown by atomic and astronomical clocks over intervals of a few years may reveal some unexpected phenomena. G. M. Brown

MECHANICS OF FLUIDS 532

532.13 : 532.584

105. ROTATIONAL VISCOMETER FOR RAPIDLY SETTLING SUSPENSIONS. A. Bhattacharya and A.N.Roy.
Analyt. Chem., Vol. 27, No. 8, 1287-90 (Aug., 1955).

A simple, sensitive, and sturdy rotational viscometer of the concentric cylindrical type has been developed to determine the apparent viscosities of some quickly settling suspensions of finely powdered solids in liquids. The essential features include continuous operation at different speeds, provision for draining out of contents, and a simple mechanical arrangement to measure the torque developed on the stationary cylinder. The viscometer was calibrated against standard glycerol-water solutions, the determinations being carried out in the turbulent range, and the data correlated as a plot of specific friction factor v. specific Reynolds number representing the calibration curve for this instrument. The design of the instrument, calibration with some liquids of known viscosity, and its applications for the measurement of apparent viscosity of some rapidly settling suspensions are presented. A.

532.137

106. LOW SHEAR CAPILLARY VISCOMETER WITH CONTINUOUSLY VARYING PRESSURE HEAD. S.H.Maron and R.J.Belner.
J. appl. Phys., Vol. 26, No. 12, 1457-60 (Dec., 1955).

A capillary viscometer is described for the study of the flow behaviour of non-Newtonian fluids at shear stresses of 0.06-20 dynes/cm^2. The all-glass instrument consists of two units connected by a balljoint, one unit of which contains the capillary while the second is essentially a manometer. As the test fluid moves through the capillary, the rate of rise of the fluid in the manometer is observed. This measurement of the column height as a function of time allows calculation of both pressure drop and rate of flow. Different combinations of capillary and manometer units can be employed interchangeably to study liquids of widely varying viscosities. Data and methods are presented which show that the instrument can be used to determine the absolute viscosities of Newtonian liquids and the flow curves of non-Newtonian fluids over the indicated shear stress region. A.

532.51

107. THE GROWTH OF SECONDARY CIRCULATION IN FRICTIONLESS FLOW. W.R. Hawthorne.
Proc. Cambridge Phil. Soc., Vol. 51, Pt 4, 737-43 (Oct., 1955).

The appearance of a component of vorticity in the direction of flow materially alters the pattern of flow of a fluid in three dimensions. Expressions are obtained for this secondary vorticity in an inviscid compressible fluid flowing under the action of body forces. They are applied to examples such as a liquid under gravity and gas flow behind a curved shock. In compressible gas flow with varying temperature but constant stagnation pressure no secondary circulation appears. In a perfect gas atmosphere it is shown that secondary circulation may appear because of non-adiabatic lapse rates as well as wind-speed gradients. It is also shown that in a liquid with a density gradient, gravitational effects can give rise to secondary vorticity components. A.

532.51 : 538.69

108. SOLUTION OF PROBLEMS INVOLVING THE HYDROMAGNETIC FLOW OF COMPRESSIBLE IONIZED FLUIDS. R. E. Loughhead.
Phys. Rev., Vol. 99, No. 6, 1678-81 (Sept. 15, 1955).

The characteristic forms of the hydromagnetic equations for a compressible fluid are examined from the viewpoint of obtaining by the method of finite differences numerical solutions for continuous initial value problems involving unidimensional motion of the fluid. A.

532.517.4

109. TURBULENCE SPECTRUM IN CHANDRASEKHAR'S THEORY. J.W.Chamberlain and P.H.Roberts.
Phys. Rev., Vol. 99, No. 6, 1674-7 (Sept. 15, 1955).

The result of Chandrasekhar's theory of turbulence (Abstr. 4408/1955) are transformed from ordinary space (used exclusively in his paper) to wave-number space. Consideration is limited to the case of stationary, homogeneous and isotropic turbulence. A "time-dependent spectrum" is defined in terms of the scalar product of eddy velocities at two different times; this spectrum is related to Chandrasekhar's time-dependent correlation function by a Fourier transform, as in the conventional, time-independent case. For infinite Reynolds number the spectrum is obtained directly by transforming the correlation function into wave-number space; the spectrum is given by a much simpler expression than is the corresponding correlation function. Consequently, an approximate (linearized) form of the differential equation for the correlation has been transformed to wave-number space, and this equation is readily solvable, even for a finite Reynolds number. For $k > 1/\nu$ the spectrum vanishes, and this cutoff at large wave-numbers is interpreted as the disintegration of turbulence into laminar flow at dimensions sufficiently small for viscosity to dominate over the inertial transfer of energy. Finally the general, nonlinear correlation equation has been transformed into an integral equation for the spectrum, but a general solution has not yet been obtained for either the spectrum or correlation. A.

532.517.4

110. STATISTICAL THEORY OF TURBULENCE. II. FOUNDATION OF SIMILARITY THEORY OF TURBULENCE. Y.Shigemitsu.
J. Phys. Soc. Japan, Vol. 10, No. 10, 890-902 (Oct., 1955).

For Pt I, see Abstr. 6789 (1955). As the first stage of development of the theory, fundamental aspects of the similarity laws are investigated through the three cases of isotropic turbulence (A), turbulent wake (B) and turbulent boundary layer (C). In (A), it is first interpreted as the essential character of shearless turbulence that the distribution function $F_0(u, v, w)$ takes the form of Gauss function without correlation. Next, the hypothesis of isotropic turbulence due to G.I.Taylor is proved to hold in the case of shearless turbulence with a uniform mean velocity distribution. Then, the hypothesis of similarity preservation introduced first by Karman and Howarth, is derived on the present theory under the supposition of ideal state. Under this supposition the diffusion law $L^2 \propto t$ is obtained. The decay law in the initial period, $u^2 \propto t^{-1}$ is derived by taking a vortex chaos motion with $\alpha = 1$. Further, the problem of energy transmission from large vortices to small ones is considered. In (B), the existence of turbulent shearing stress is attributed to the form of P-function. Next, the initial-period similarity law in (A) is extended into this case of shear turbulence. Theoretical results are derived and compared with experimental measurements. The fundamental hypotheses in transfer theory in this case are derived from this extended similarity law. The transition of the similarity law from the initial period to the final period is surveyed experimentally. In (C), the existence of a laminar sublayer is first attributed to the stability theory of laminar viscous flow. By introducing such an interpretation, it can be proved that the Reynolds stress at a point is not determined as a function of this point only, and the previously derived similarity law in the initial period is developed into the non-decaying type. The theoretical result under a constant pressure distribution is compared with experiment. For the distribution of Prandtl's mixture length, the relation $l(\eta)$ varies as $(\eta - \eta_0)^{1/2}$ is derived, where η_0 corresponds to the boundary of the laminar sub-layer. A.

532.525 : 531.578

111. ON THE JET FORMATION BY EXPLOSIVES WITH LINED HEMISPHERICAL CAVITIES. S.Singh.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 785-9 (Oct., 1955).

It is assumed that when a thin plate is struck by a detonation wave whose velocity of propagation is D, the plate attains a velocity V given by $V = 0.25\,D\,(1 + \sin\alpha)$ where α is the angle between the detonation front and a normal to the plate. Using this relation and the hydrodynamic theory of jet formation developed by Birkhoff et al. (Abstr. 3117/1948), the change in shape of a hemispherical liner as it collapses under impact of a plane axial detonation wave is calculated; good agreement is found with experimental observation. It is further shown that no separation into a fast jet followed by a slow massive slug is to be expected; and that elements near the base of a hemispherical liner do not contribute to jet formation. A.Schofield

CAPILLARITY 532.6

532.61

112. THE INTERNAL PRESSURE OF LIQUIDS. C. Sălceanu.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 366-8 (July 25, 1955). In French.

The author has proposed previously an equation for sur-

face tension in terms of the number of molecules per unit length and compressibility. Making the supposition that the internal pressure is proportional to the number of molecules per unit area, an expression is obtained for the internal pressure results which is simply related to that for the surface tension. Internal pressures calculated from the equation are given for a number of liquids. Arguments are advanced to justify the results. F. E. Hoare

532.612.4

113. SURFACE TENSION OF ETHER AND PENTANE.
T.O.Jeffries, M.Derrick and B.Musgrave.
J. chem. Phys., Vol. 23, No. 9, 1730 (Sept., 1955).

Measurements, by means of the capillary rise method, of the surface tension of ether and pentane in contact with their own vapour have been made up to temperatures approaching their critical points. The results are given for 12 temperatures from 21.0° C to 159.9° C in the case of n-pentane and for 9 temperatures from 126.2° C to 148.5° C in the case of ether. J.Iball

532.612.4

114. SURFACE TENSION TEMPERATURE RELATION.
S.S.Mitra and N.K.Sanyal.
J. chem. Phys., Vol. 23, No. 9, 1737-8 (Sept., 1955).

From known equations relating (1) vapour pressure and surface tension, (2) surface tension and density, and (3) temperature and vapour pressure, an equation, $S^{5/6} = A - BT$, is obtained giving a relation between surface tension (S) and absolute temperature (T), A and B being constants. The equation gives good agreement with experiment for nonassociated pure liquids, e.g. benzene, for which A = 34.76 and B = 0.06233. For associated liquids the equation is valid only over small ranges. J.Iball

MOLECULAR THEORY OF LIQUIDS 532.7

532.7

115. POTENTIAL ENERGY OF A MOLECULE IN A LIQUID. L.A.Girifalco.
J. chem. Phys., Vol. 23, No. 9, 1728 (Sept., 1955).

Considering one molecule in a spherical shell radius R its potential energy is the product of the intermolecular potential function and the radial distribution function. Integration is first performed to obtain the energy of interaction between the central molecule and the shell and then over R from $R = R_0$ to ∞ in order tocover the effect of the remainder of the liquid (R_0 = distance of closest approach of two molecules). T.C.Toye

532.7

116. INTERNAL PRESSURE OF CARBON TETRACHLORIDE BETWEEN −7° AND 70°. H.Benninga and R.L.Scott.
J. chem. Phys., Vol. 23, No. 10, 1911-14 (Oct., 1955).

Measurements of $(\partial P/\partial T)_V$ of carbon tetrachloride at ten different temperatures between −7 and 70° C yield an equation for the internal pressure $(\partial E/\partial V)_T = 3346\left[1-2.97\times10^{-3}(t-25)-12.6\times10^{-6}(t-25)^2\right]$ atmospheres. Comparison with the cohesive energy density ($\Delta E^V/V$) confirms previous observations (Hildebrand and coworkers) that the ratio of the internal pressure to the cohesive energy density is approximately unity and further shows this ratio to be remarkably constant over the entire 77° range of temperature. The experimental data on the internal pressure are in marked disagreement with the predictions of "free-volume theory" (Lennard-Jones and Devonshire, Hirschfelder and co-workers). A.

532.7 : 534.23

117. THE IMPORTANCE OF DIFFERENT EXPERIMENTAL CONDITIONS IN THE ACTION OF ULTRASOUND.
A.Dognon and Y.Simonot.
J. Chim. phys., Vol. 52, No. 6, 486-91 (June, 1955). In French.

A study of the influence of the liquid height, form and material of the vessel, as well as its surface treatment, on the energy behaviour of ultrasound. T.C.Toye

532.7 : 535.435

118. APPLICATION OF THE DEGREE OF DEPOLARIZATION OF SCATTERED LIGHT TO THE STUDY OF INTERACTIONS IN A FLUID. H.Benoit.
J. Phys. Radium, Vol. 16, No. 7, 66 S - 68 S (July, 1955). In French.

Develops a theory which relates a value of anisotropy, measured from depolarization values, to the anisotropy of the individual molecules and the compressibility. Its use should permit a calculation of the correlations between the orientations of the molecules. G.F.Lothian

532.72

119. PHENOMENA IN THE BOUNDARY LAYER OF TWO LIQUID PHASES. K.Sigwart and H.Nassenstein.
Naturwissenschaften, Vol. 42, No. 16, 458-9 (1955). In German.

Notes on studies, made visually in projection, and photographically on cinefilm, of diffusion processes between two liquids, and in particular of the occurrence of pronounced turbulence effects. A.Beer

532.72

120. SELF-DIFFUSION OF LIQUID SODIUM. R.E.Meyer and N.H.Nachtrieb.
J. chem. Phys., Vol. 23, No. 10, 1851-4 (Oct., 1955).

The self-diffusion of liquid sodium in the temperature range, 98° to 226°, has been studied by the capillary reservoir technique. The data fit the empirical equation, $D = 1.10\times10^{-3}\exp(-2430/RT)$. The Stokes–Einstein equation gives a good correlation of the self-diffusion and viscosity data. The difference in the self-diffusion coefficients of the solid and liquid sodium is explained in terms of the "relaxation" theory of diffusion proposed by Nachtrieb and Handler. A.

532.73

121. STRUCTURE OF AQUEOUS SOLUTIONS OF HALIDES OF ZINC AND CADMIUM. F.Debot.
Physica, Vol. 21, No. 8, 605-28 (Aug., 1955). In French.

The X-ray scattering from aqueous solutions of $ZnCl_2$, $ZnBr_2$, ZnI_2, $CdCl_2$, $CdBr_2$ and CdI_2 of various concentrations has been investigated. The primary X-ray beams of CuKα and MoKa were made monochromatic by reflection from a curved crystal and the scattered beams were measured with a Geiger-Müller counter spectrograph. The scattering curves have been interpreted on the basis of the theory of Zernike and Prins (Z. Phys., Vol. 41, No. 2-3, 184-94, 1927) and the results permit a much more precise description of the molecular arrangement in these solutions than has been possible before. In certain cases it is shown that two of the solute molecules are in 'contact', without the interposition of H_2O molecules. Tables are given showing the intramolecular and intermolecular distances and many of the scattering curves are reproduced. J. Iball

532.74 : 534.23

122. ULTRASONIC ABSORPTION IN ANILINE–NITROBENZENE AND ANILINE–ETHYL ALCOHOL MIXTURES.
D.Sette.
Acustica, Vol. 5, No. 3, 195-6 (1955).

A minimum in absorption coefficient α occurs in both cases at about 0.3 aniline mole fraction. This cannot be explained in the same way as for mixtures of unassociated

liquids since molecular association is certainly present, furthermore the observed decrease in α with increasing temperature shows that the effect must be due to some equilibrium which is disturbed by heating. Study of α obs./α calc. v. temperatures and α/f^2 v. f indicates that the extra sound absorption is attributable to structural equilibrium which are disturbed by the pressure variations in the ultrasonic waves.
T.C.Toye

MECHANICS OF GASES 533

533.16

123. ON THE VISCOSITY RATIO BETWEEN ORTHO- AND PARA-HYDROGEN. G.Falk and A.Mann.
Z. Phys., Vol. 142, No. 3, 277-96 (1955). In German.

The experiments of Becker and Stehl (Abstr. 8004/1952) show that at 20° K the viscosity of H_2 increases with increasing content of para-H_2. This is in contradiction with theoretical predictions based on the Ehrenfest–Oppenheimer symmetry rule and an intermolecular potential which is independent of spin. The bases of this prediction are re-examined and it is concluded that the introduction of spin-dependent forces cannot change the sign of the theoretical result. The contradiction is therefore still unexplained. R.O.Davies

533.275 : 621.317.79

124. A NEW ELECTRICAL HYGROMETER. W.C.White.
Elect. Engng, Vol. 73, No. 12, 1084-7 (Dec., 1954).

The hygrometer element is a small cylindrical core of alumina, saturated with a water solution of LiCl or $Na_2Cr_2O_7$, the conductivity of which varies with relative humidity (r.h.). Two coils of Pt wire are wound on the former and form the electrodes. The conduction-current/r.h. characteristic of this simple arrangement is a straight line for r.h. values above a certain threshold. The characteristic may be modified by passing a small heating current through one of the coils. A further modification may be effected by inserting a high impedance (50 000 ohms or more) in the circuit. This steepens the curve considerably and can be made to give a sharp transition from one stable state to another. The r.h. at which this occurs may be varied by changing the heater coil current. This mode of operation is useful for relay operation at a given r.h. The temperature coefficient of conductivity is positive and may be compensated by a small increase of heater current. The explanation of this paradox is that the heater current raises the temperature of the element above ambient, giving rise to a drying-out action which lowers the conductivity. The response time varies from a few minutes at high temperatures and high r.h. to an hour or more at low temperature and r.h., but can be modified by a change in heater current. W.G.Stripp (R)

533.5

125. METHODS FOR MEASURING LOW GAS PRESSURES BY MEANS OF THE AUTOMATIC GAS DISCHARGE IN A TRANSVERSE MAGNETIC FIELD. R.Haefer.
Acta phys. Austriaca, Vol. 9, No. 3-4, 200-15 (1955). In German.

Four methods of determining low gas pressures by measuring magnetic and electric variables are investigated. Applicability, advantages, disadvantages, sources of error and effects of the type of gas present are discussed. These methods, separately or combined, have a measuring range of 10^{-1} to 10^{-8} mm Hg. G.Wittenberg

533.5 : 531.788.7

126. A SIMPLE AND RELIABLE IONIZATION MANOMETER. E. Bouwmeester and N. Warmoltz.
Philips tech. Rev., Vol. 17, No. 4, 121-5 (Oct., 1955).

An ionization manometer with four electrodes is described. The ionizing electron current is stabilized by means of a grid at constant potential placed near to the cathode and a high resistance in the cathode circuit. The ion current is measured with a Wheatstone-bridge, two of whose branches consist of pentodes, the other two branches being resistors. The ion current passes through the control-grid circuit of one of the pentodes, thus unbalancing the bridge. A microammeter serves as the indicating instrument. Some measures for improving the accuracy at low pressures are discussed. The measuring range extends from about 10^{-2} mm Hg to approximately 10^{-8} mm Hg. The lower limit is restricted by the fact that under the influence of X-rays from the anode, electrons are liberated from the collector. A.

533.5 : 539.217 : 666

127. OUTGASSING OF GLASS. B. J. Todd.
J. appl. Phys., Vol. 26, No. 10, 1238-44 (Oct., 1955).

The gas evolved from glass at temperatures below the softening point, which is of interest in bake-out problems, is primarily water. The water evolved from unit surface at constant temperature above 300° C is linear with respect to the square root of the time of bake-out. The intercept of the linear plot, which can be altered by different surface treatments, is a measure of the easily removed water residing at the surface. The slope is a measure of the rate of evolution of water that has diffused to the surface from the interior. Values of the diffusion constant for water and concentration gradients after bake-out have been calculated for a soda-lime glass. The diffusion constant is an exponential function of the reciprocal of the absolute bake-out temperature. Values of the activation energy for the diffusion process are given for eight glasses. A method of calculating the amount of water that will diffuse from glass for any time–temperature conditions following any bake-out is presented. A.

533.6.011 : 534.222.2

128. REFLECTION OF A COMPRESSION WAVE FROM A SYMMETRICAL WEDGE. R.W.Skulski and D.Weimer.
J. appl. Phys., Vol. 26, No. 11, 1344-53 (Nov., 1955).

Compression waves generated by paper pistons accelerated by shock waves in a shock tube have been reflected from a symmetrical wedge. Studies of the density fields in the interaction region have been made with an interferometer, and the parameters, "wave age" distance up the wedge, and angle of incidence have been investigated over a range of incidence angles from 25° to 80° and "effective shock strengths" from $\xi = 1.1$ to $\xi = 2.0$. The limit of regular reflection for this type of wave is shown to exist theoretically, and this limit has been verified experimentally. Beyond this limit a type of Mach reflection occurs. A.

533.6.011.3

129. A DERIVATION OF GUDERLEY–BARISH'S SOLUTION FOR THE SONIC FLOW ON THE BASIS OF THE THIN-WING EXPANSION METHOD. K.Hida.
J. Phys. Soc. Japan, Vol. 10, No. 11, 1011-17 (Nov., 1955).

It is shown that Guderley and Barish's asymptotic solution for the sonic flow, which is valid far from the body, can also be derived on the basis of the thin-wing expansion method as extended by Imai. Although Imai's formula cannot be applied to axisymmetrical cases, yet the first term of the asymptotic solution in these cases can be obtained as well by means of usual formula based on the linear theory. A.

533.6.011.5

130. ON SOME SINGULAR SOLUTIONS OF THE TRICOMI EQUATION RELATING TO TRANSONIC FLOW. K.Hida.
J. Phys. Soc. Japan, Vol. 10, No. 10, 869-81 (Oct., 1955).

Two singular solutions of the Tricomi equation relating to transonic flow are presented, both of which have a singularity corresponding to a uniform flow at infinity upstream — either subsonic or supersonic — and tend to Guderley's solution when the Mach number at infinity approaches unity. First, the so-

lutions are given formally in integral forms, and then their analytic continuations, which are valid within various portions in the hodograph plane, are studied. Special references are also made to the behaviour of the solution in the vicinity of the singular point. A.

533.6.011.5

131. ASYMPTOTIC BEHAVIOUR OF THE LOCATION OF A DETACHED SHOCK WAVE IN A NEARLY SONIC FLOW. K.Hida.
J. Phys. Soc. Japan, Vol. 10, No. 10, 882-9 (Oct., 1955).

Applies the Tricomi equation solutions of the preceding abstract. The distance, b, of a detached shock wave from an obstacle and the curvature of a shock at its nose, 1/R, vary, respectively, as $1/b \propto (M_\infty - 1)^2$, $1/R \propto (M_\infty - 1)^3$, M_∞ being the Mach number at infinity. In axisymmetrical cases, similar results can be obtained by assuming that the flow behind a detached shock wave may be expressed by the asymptotic solution of the sonic flow due to Guderley and Barish. The results are $1/b \propto (M_\infty - 1)^{2/3}$, $1/R \propto (M_\infty - 1)^{5/3}$. A.

MOLECULAR THEORY OF GASES 533.7

533.7

132. EFFECT OF ORIENTATIONAL FORCES ON SECOND VIRIAL COEFFICIENTS. B.J.Castle, J.M Dawson and L.Jansen.
J. chem. Phys., Vol. 23, No. 9, 1733 (Sept., 1955).

Theoretical results obtained by previous authors are adversely commented on. Suggestions are put forward for improving the accuracy of the theory. R.Eisenschitz

533.75

133. VIRIAL SERIES OF THE IDEAL BOSE–EINSTEIN GAS. H.S.Shapiro.
Phys. Rev., Vol. 99, No. 6, 1673-4 (Sept. 15, 1955).

Widom (Abstr. 10896/1954) conjectured that the radius of convergence of the virial series of the ideal Bose–Einstein gas is infinite. The present note shows this to be false. A.

533.75 : 534.222.2 : 539.132

134. EQUATION OF STATE OF GASES BY SHOCK WAVE MEASUREMENTS. I. EXPERIMENTAL METHOD AND THE HUGONIOT OF ARGON. R.H.Christian and F.L.Yarger.
J. chem. Phys., Vol. 23, No. 11, 2042-4 (Nov., 1955).

An experimental method is described for the simultaneous measurement of the velocity of a plane shock through a gas and the associated particle velocity. Shocks are generated by a plate driven by a high-explosive system. The velocities are recorded by a high-speed rotating-mirror smear camera with a precision of about $\pm \frac{1}{2}\%$. Data are presented defining the Hugoniot of argon between 200 and 1100 Los Alamos atmospheres. These data are compared with the theoretically predicted Hugoniot. A.

533.75 : 534.222.2 : 539.132

135. EQUATION OF STATE OF GASES BY SHOCK WAVE MEASUREMENTS. II. THE DISSOCIATION ENERGY OF NITROGEN. R.H.Christian, R.E.Duff and F.L.Yarger.
J. chem. Phys., Vol. 23, No. 11, 2045-9 (Nov., 1955).

The results of equation of state measurements made behind strong shock waves in nitrogen are consistent only with the higher of the two spectroscopically acceptable values of the dissociation energy of nitrogen, 9.764 eV. A.

VIBRATIONS . ACOUSTICS 534

534.121.1

136. PRODUCTION OF CHLADNI FIGURES ON VIBRATING PLATES USING CONTINUOUS EXCITATION. H.C.Jensen.
Amer. J. Phys., Vol. 23, No. 8, 503-5 (Nov., 1955).

A method of producing Chladni figures by continuous excitation is described. Thin metallic plates are placed in the sound field of a 15 watt (or higher) loud-speaker driven by an audio-oscillator and power-amplifier combination. Advantages of this method, especially for demonstration purposes, are enumerated. A.

534.21

137. DISPERSION AND SIMPLE HARMONIC POINT SOURCES IN WAVE DUCTS. I.Tolstoy.
J. Acoust. Soc. Amer., Vol. 27, No. 5, 897-908 (Sept., 1955).

In a previous article (Abstr. 4443/1955) it was shown that if plane wave reflection coefficients were written as rotations, the characteristic equation for the normal modes could be expressed very simply by means of the arguments. The method is elaborated here for the case of multilayered media. Also, an exact and general solution for the guided wave terms due to a simple harmonic point source in a duct is obtained. This is done by applying the characteristic equation to an integral solution due to Brekhovskikh. A numerical example is given, illustrating quasi-resonance and anti-resonance phenomena associated with stationary values of the group-velocity under simple-harmonic conditions. A.

534.21

138. PROPAGATION OF SOUND IN THIN ELASTIC SHELLS. J.E.Young.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1061-4 (Nov., 1955).

A wave theoretical analysis of symmetric mode propagation in a medium confined by a cylindrical elastic shell is carried out. An expression is obtained for the axial propagation constant, specialized to that case of a thin steel shell surrounding a column of air. This is further restricted to the description of the lowest symmetric mode. The dispersion predicted by the analysis is in order of magnitude agreement with that obtained on a transmission line picture. A.

534.21

139. PHASE VELOCITIES AND DISPLACEMENT CHARACTERISTICS OF FREE WAVES IN A THIN CYLINDRICAL SHELL. P.W.Smith, Jr.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1065-72 (Nov., 1955).

Results are presented giving values of the phase velocities and the relative magnitudes of the components of displacement for all possible free waves in the wall of a thin, elastic, cylindrical shell. Three classes of waves are identified and their natures are discussed as frequency is varied continuously. The vibrations are interpreted not only as standing waves and waves progressing in the axial direction, but also as fully free waves travelling in a helical direction in the wall of the cylinder. A.

534.21 : 533.6.011

140. ACOUSTICAL STREAMING IN THE VICINITY OF A SPHERE. C.A.Lane.
J.Acoust. Soc. Amer., Vol. 27, No. 6, 1082-6 (Nov., 1955).

Recent studies have led to a satisfactory understanding of the details of acoustical streaming in the vicinity of a cylinder. Similar studies have now been completed for a sphere. In general, the steady flow around a sphere and the characteristic parameters are very much like what has been found for the cylinder. An experimental verification of the theory has been attempted by comparing the observed d.c. boundary-layer thickness with that found from the theory. This is

summarized in a curve of d(dc)/d(ac) v. a/d(ac), where d(dc) is the d.c. boundary-layer thickness, d(ac) is the a.c. boundary-layer thickness, and a is the radius of the sphere. A.

534.21 : 535.41

141. FIXED PATH, VARIABLE FREQUENCY ACOUSTIC INTERFEROMETER. H.I.Leon.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1107-12 (Nov., 1955).

The interferometer described is particularly suited for measuring ultrasonic velocities in liquids as a continuous function of temperature and pressure of the medium. It contains two clamped crystals: one, a low intensity ultrasonic source; and the other, a fixed, parallel reflector. The frequency of excitation, supplied from a frequency generator, is varied and cyclic changes in input impedance are detected in an impedance bridge circuit. Crystal resonance is avoided. The interferometer, in addition to the usual advantages of a fixed path system over a variable path one, operates at very low power levels; hence, it avoids problems occasioned by high-intensity pressure waves. Frequency, the measured variable, is one that can be precisely measured with comparative ease. The complete equivalent network for either the fixed or variable path interferometer is presented, from which the operation of the fixed path, variable frequency system is derived. The effect of crystal backing impedance is discussed, and the characteristics of the interferometer are shown to be those of a double-crystal interferometer having infinite backing impedance. The velocity of sound in water is measured between 25 and 53°C in the frequency range of 600 to 800 kc/s. At 25.0°C the measured velocity is 1496.8 ± 0.3 metres/second, and the temperature coefficient is + 2.7 metres/second.°C. A.

534.213 : 533.6.011

142. NOTES ON THE EXACT EQUATIONS GOVERNING THE PROPAGATION OF SOUND IN FLUIDS. F.V.Hunt.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1019-39 (Nov., 1955).

The assumption underlying the exact equations of motion for thermoviscous fluid are reviewed and the complete equations are given, for reference convenience, in both tensor and vector form. The first- and second-order acoustic equations are then exhibited and used to obtain the source terms that account for the generation of vorticity and streaming. In order to preserve a broad base from which to make the approximations appropriate under various circumstances, all terms are retained explicitly including those arising from any functional dependence of the viscosity and thermal coefficients on the state variables. The distinction between spatial and material coordinate systems is carefully drawn and conversion transforms are derived rigorously and their use illustrated. The general properties of finite-amplitude waves are demonstrated by including the second-order terms in a plane-wave solution of the exact wave equation in material coordinates, with special concern for the effects of large amplitude on speed of propagation and on wave-form distortion. Sound absorption and dispersion measures for a viscous conducting fluid are analysed in terms of Truesdell's recent exact solution of the first-order secular equation. These differ characteristically from the corresponding measures predicted for pure relaxation in a two-fluid mixture. It is concluded that a complete and adequate theory of sound absorption and dispersion will need to take into account both relaxation and viscothermal phenomena as well as their interaction, and that until such a general theory is available, the exact theory of viscothermal effects — rather than the crude linear approximation commonly, but inappropriately, called "classical" — should be used in computing the "excess" absorption and dispersion to be accounted for by relaxation processes. The exact solutions of the secular equation permit a new evaluation, in series form, of the characteristic acoustic impedance for a thermoviscous medium. The notes conclude with a revised account of the spectral character of thermal noise in the acoustic medium based on the quantum hypothesis and a merger of the concepts of architectural acoustics and specific-heat theory. A.

534.22

143. CONTRIBUTION TO THE TECHNIQUE OF THE MEASUREMENT OF ULTRASONIC VELOCITY IN LIQUIDS. M. De Rossi.
Ricerca sci., Vol. 25, No. 8, 2334-9 (Aug., 1955). In Italian.

A detailed account of the technique of measurement and a description of an apparatus especially developed for the determination of the propagation velocity of ultrasonic waves in liquids. A.

534.22

144. VARIATION OF ELASTIC WAVE VELOCITY WITH FREQUENCY IN FUSED QUARTZ AND ARMCO IRON. D.S.Hughes and J.M.Kennel.
J. appl. Phys., Vol. 26, No. 11, 1307-9 (Nov., 1955).

The velocity dispersion in fused quartz and in Armco iron was investigated by measuring the resonant frequency of small cylinders using quartz crystals on the ends as drivers and detectors. With X-cut crystals and Y-cut crystals the computed velocities of the dilatational waves in the range 2.0-5.0 Mc/s and shear waves in the range 1.5-3.0 Mc/s decrease with frequency. This decrease in both cases is regarded as unreasonably large and is ascribed primarily to sample geometry. Simple standing plane waves, either dilatational or shear, cannot satisfy the boundary conditions in a free cylinder. A mosaic crystal was then constructed of sectors of Y-cut crystals such that the driver generated and the detector transmitted only torsional waves. With these crystals and viscous coupling between crystals and sample, the velocity in fused quartz was constant within ± 1 m/sec for the frequency range 0.6-3.0 Mc/s. The velocity in Armcoe iron was constant within ± 2 m/sec in the range 0.5-1.5 Mc/s and decreased about 10 m/sec in the range 1.5-3.0 Mc/s. A.

534.22 : 536.71

145. THE CALCULATION OF SOUND VELOCITY IN GASES AND LIQUIDS BY MEANS OF A NEW THERMAL EQUATION OF STATE. J. Himpan.
Z. Phys., Vol. 141, No. 5, 566-70 (1955). In German.

A relation for the velocity of sound is derived from a modified form of Van der Waals equation. The theory gives results in good agreement with observations on CO_2.

T.C.Toye

534.222.2

146. POSITIVE ION OSCILLOSCOPE TRIGGER FOR SHOCKS IN LOW-DENSITY GASES. D.Venable.
Rev. sci. Instrum., Vol. 26, No. 7, 729 (July, 1955).

Positive ions are injected into a shock tube through a hole 0.5 mm dia. in the tube wall, and are collected at a needle point approx. 1 mm from the hole. The ion current passes to earth through an external resistor, the voltage across which varies when a shock wave passes through the ion stream; when amplified the voltage variation serves as an oscilloscope trigger. The system overlaps conventional methods of detecting shock wave propagation and is applicable at lower pressures; it has been shown to function satisfactorily for shock waves in He, A, and N_2 where the pressure ahead of the shock ranged from 0.05 to 5 mm Hg, and the compression across the disturbance varied from 2 to 3.8. A. Schofield

534.222.2

147. IMPROVED WAVE DIAGRAM PROCEDURE FOR SHOCK REFLECTION FROM AN OPEN END OF A DUCT. G.Rudinger.
J. appl. Phys., Vol. 26, No. 11, 1339-42 (Nov., 1955).

Recently derived improved boundary conditions for the reflection of weak shock waves from an open end of a duct can be well approximated by a centred expansion wave if the centre

of the later is located on the leading characteristic of the reflected wave and some distance e outside the duct. A relation is derived between e/D (D is the duct diameter), the shock pressure ratio p_1/p_0, and γ (the ratio of specific heats). This relationship is represented with sufficient accuracy by the empirical formula

$$e/D = (0.90 + 0.677/(p_1/p_0) - 1)(\gamma + 1.08) - 3.8.$$

This result makes it possible to apply the improved boundary conditions without losing the convenience of the customarily used wave diagram procedure. A.

534.222.2 : 536.71

148. ENTROPIC EQUATIONS OF STATE AND THEIR APPLICATION TO SHOCK WAVE PHENOMENA IN SOLIDS. G.E.Duvall and B.J.Zwolinski.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1054-8 (Nov., 1955).

The front of a shock wave in an ideal fluid is characterized by a discontinuous transition from the undisturbed state to a highly compressed state in which the entropy of the fluid has increased. The relations between pressure, density, propagation velocity, and particle velocity behind the shock front are represented by the equations for conservation of mass, momentum, and energy and by the equation of state of the fluid. The entropy change produced by the transition is third-order in the compression for weak shocks. The propagation of shock waves through metals can be described by a hydrodynamic theory which assumes that the metal is an ideal fluid behind the shock front, and that the hydrostatic equation of state is applicable there. Three hydrostatic equations of state for Al, Cu, Fe, and Pb are compared with experimental data at low pressures and quantum mechanical calculations at pressures up to several hundred megabars. With these equations of state the hydrodynamic theory is used to calculate explicitly the entropy increase across the shock front, the amount by which the pressure exceeds the adiabatic pressure for a given compression, and the temperature rise after the shock pressure has been relieved for the metals mentioned above. A.

534.23 : 532.7

149. SOUND ABSORPTION IN LIQUIDS IN RELATION TO THEIR PHYSICAL PROPERTIES. VISCOSITY AND SPECIFIC HEATS. S.Parthasarathy and A.F.Chhapgar.
Ann. Phys. (Leipzig), Vol. 16, No. 5-8, 297-303 (1955).

From a study of the physical properties of liquids such as viscosity, sound absorption and the ratio of specific heats in relation to molecular constitution, a few general rules regarding sound absorption have been derived. It has been found that in all cases, the excess absorption decreases with increasing molecular weight in the same manner as that of the ratio of specific heats. That the ratio of specific heats is as important as viscosity in sound absorption at high frequencies is clearly brought out. A.

534.23 : 532.7

150. SOUND ABSORPTION IN LIQUIDS IN RELATION TO THEIR SPECIFIC HEATS. II. S. Parthasarathy and D.S.Guruswami.
Ann. Phys. (Leipzig), Vol. 16, No. 5-8, 287-96 (1955).

It has been shown in an earlier paper (preceding abstract) that the complete formula for observed sound absorption contains the factor $\frac{3}{4}/(\frac{3}{4} - \gamma)^4$ in addition to the Stokes — Kirchhoff term. While positive and negative temperature coefficients of absorption cannot be explained by any of the existing theories, the new formula well explains both through such variation of γ with temperature. In a similar manner absorption with pressure is accounted for. It is noticed that at the critical point in liquid-vapour systems the sound absorption is very great and γ is also large, which accounts for large sound absorption. Similar behaviour is noticed in binary liquid mixtures also, at the critical temperature, where sound absorption has been found to be enormous. A.

534.232

151. DIRECTIONAL CHARACTERISTICS AND MECHANICAL IMPEDANCE OF A CYLINDRICAL SOURCE WITH RADIAL VIBRATION. M. Federici.
Ricerca sci., Vol. 25, No. 6, 1423-30 (June, 1955). In Italian.

The acoustical radiation field of a cylinder with radial vibration is examined and it is shown that its directional characteristic can be expressed as a product of two terms, the first of which is a trigonometrical function of the height of the cylinder and the second is a Bessel function of the radius of the cylinder. The mechanical impedance of the source is also examined and it is shown that when the ratio of the height of the cylinder to the wavelength is high the mechanical impedance is given by the ratio of two Bessel functions. Curves are given which permit an immediate calculation of the parameters involved. A.

534.232

152. DIRECTIONAL SOUND. K.Feik.
Hochfrequenztech. u. ElektAkust., Vol. 64, No. 2, 35-62 (Sept., 1955). In German.

The theory is given of the directional propagation of sound from various types of sound source. Consideration is given to the radiated sound power, the directional characteristics and amplification factor of various arrays and combination of sound sources. These include: (1) piston sources; (2) line groups; (3) circular groups; (4) spherical groups; (5) single and double radiators, and combinations of these. Diagrams are given of the radiation characteristics of these groups, and three-dimensional models are also reproduced. A.B.Wood

534.232

153. ON THE EFFICIENCY OF AN ACOUSTIC LINE SOURCE WITH PROGRESSIVE PHASE SHIFT. G.J.Thiessen.
Canad. J. Phys., Vol. 33, No. 11, 618-21 (Nov., 1955).

The introduction of a small continuous phase shift along the length of a finite line source does not result in a decrease of energy radiated but simply causes the directionality pattern to change. When the phase shift is such that it corresponds to the phase shift with distance on a sound wave, then the directionality pattern has changed through 90^0 and the energy radiated begins to drop rapidly. At this point the slope of the curve of energy v. phase shift parameter increases with increasing frequency. A.

534.232

154. DIRECTIONAL PROPERTIES OF CONTINUOUS PLANE RADIATORS WITH BIZONAL AMPLITUDE SHADING. G.E.Martin and J.S.Hickman.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1120-7 (Nov., 1955).

The problem of reducing the levels of the minor lobes of linear, rectangular, and circular radiators is considered theoretically. The shading is accomplished by using equi-phase normal-velocity distributions limited to two discrete amplitudes. Relationships are derived for the sound-intensity directivity pattern and the directivity index of each radiator. An exhaustive study of various directional properties of such radiators is undertaken. This information is presented in terms of the behaviour of the major-lobe width, minor-lobe levels, and directivity index as functions of (1) the ratio of the two normal-velocity amplitudes and (2) the fraction of the unit having the higher source amplitude. It is shown that linear and rectangular radiators with such source distributions can be designed so that all minor-lobe levels are at least 21 decibels lower than the major-lobe level; the corresponding value for the circular radiator is 28 decibels. The resultant increase in major-lobe width is approximately twenty percent. The results are presented so as to provide criteria for the effective use of this method in transducer design. A.

534.232 : 534.81 : 534.42

155. FUNDAMENTAL ACOUSTICS OF ELECTRONIC ORGAN TONE RADIATION. D.W.Martin.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1113-19 (Nov., 1955).

The acoustical effects achieved and the techniques used in the radiation of organ tone are quite different from the conventional effects and practices of public-address sound systems. For the latter, point-source radiation with high uniform directivity and a minimum of reverberation are sought, in general, for the creation of the illusion of "presence" of the original sound source. However in organ music the sound sources and their images are widely distributed in space. This is especially true in those typical cases where the tone sources are enclosed in an organ chamber, or are installed in a highly reverberant environment. Another distinctive feature of organ tone radiation systems is the relative importance of the octave below 60 c/s. This paper contains design principles for electronic organ tone chambers and describes several types of organ tone cabinets now in use. Examples of the application of organ installation principles are given. A.

534.24

156. REFLECTION AND TRANSMISSION OF SOUND BY A MOVING MEDIUM. J.B.Keller.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1044-7 (Nov., 1955).

The reflection and transmission of sound by a moving medium are investigated theoretically and the reflection and transmission coefficients are determined. These coefficients are found to depend only upon that component of the velocity of the medium which lies in the plane of incidence. The reflection coefficient increases with the velocity of the moving medium until a velocity is reached at which total reflection occurs. Total reflection persists until a still higher velocity is reached above which the reflection coefficient decreases as the velocity increases. A.

534.242

157. WEDGE-SHAPED (ACOUSTIC) CAVITY RESONATORS. E.Kohlsdorf.
Hochfrequenztech. u. ElektAkust., Vol. 64, No. 1, 33-4 (July, 1955). In German.

Starting from the wave equation in a horn, the resonant frequency of the wedge is found graphically as the intersection of a straight line and a curve of the ratio of two Bessel functions. The resonances measured on models agree quite well with theory, but for wide wedges and wedges filled with absorbing material the frequencies are lower. This tendency is to be expected. S. C. Dunn

534.37 : 536.22

158. HEAT CONDUCTION LOSSES IN THE ACOUSTIC BOUNDARY LAYER. J.E.Young.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1039-43 (Nov., 1955).

The attenuation resulting from heat conduction of the quasi-plane mode in a cylindrical conduit is discussed in the high-frequency (narrow boundary layer) limit. The heat conduction part of the Kirchhoff losses is derived by means of a volume integral whose physical interpretation can be given. Preliminary to considering the Kirchhoff case, the heat conduction attenuation of a plane wave is computed to illustrate the use of the integral form. Finite thermal conductivity of the walls, as it gives rise to attenuation in guided propagation, is also discussed. A.

534.372

159. MECHANICAL RELAXATION OF SINGLE CRYSTALS OF ICE. H.O.Kneser, S.Magun and G.Ziegler.
Naturwissenschaften, Vol. 42, No.15, 437 (1955). In German.

Single crystals of ice 1 cm dia. and 5 cm long, with c axis along the length of the crystal, showed a maximum damping at a frequency which varied with temperature according to an activation energy of 0.37 eV. The decrement—frequency relation is $\delta = \delta_{max}[2\omega\tau/(1+\omega^2\tau^2)]$ with δ max = 2.9 x 10^{-2}. The value of activation energy lies within the range observed in dielectric measurements on specimens of different purity. W.M.Lomer

534.512.1

160. KUNDT TUBE DUST STRIATIONS. R.A.Carman.
Amer. J. Phys., Vol. 23, No. 8, 505-7 (Nov., 1955).

An interesting anomaly in the familiar Kundt tube experiment and the eighty-year search for an interpretation is reviewed for teachers of physics. Unfortunately the correct explanation of this phenomenon, although available, is rarely cited and known to very few. The work and explanation of Andrade are presented and expanded in hopes of remedying this situation. A.

534.612.4

161. PROBE MICROPHONE ANALYSIS AND TESTING AT HIGH TEMPERATURES AND HIGH INTENSITIES. K.W.Goff and D.M.A.Mercer.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1133-41 (Nov., 1955).

A probe microphone has been developed suitable for measuring sound fields within such structures as altitude wind tunnels and jet-engine test cells. This paper describes the methods of testing and analysing the instrument. The microphone consists of a $\frac{3}{8}$ in. inside diameter probe tube with a porous metal tip, a condenser microphone, and a spiral resistive termination. It operates at sound-pressure levels up to 170 db with 2% distortion, at ambient pressures down to 0.2 atmosphere, and with probe tip temperatures up to 900° F. The normal incidence response is flat within ±3 db from 10 to 10 000 c/s. An electrical analogue of the acoustical system is given as a basis for explaining and predicting the performance of the microphone under varying ambient conditions. It appears that the microphone can be used satisfactorily as a cavity terminated probe microphone for frequencies below the frequency at which the spiral termination ceases to be "anechoic". The required length of the spiral termination is then determined by the probe-tube length rather than the lowest frequency of interest. Testing methods and apparatus are discussed, including a high-temperature flow resistance apparatus, a low-pressure test chamber, and a resonant tube device for developing sound pressures up to 175 db with low distortion. A.

534.78

162. IMPROVEMENTS IN MESSAGE RECEPTION RESULTING FROM "SEQUENCING" COMPETING MESSAGES. J.C.Webster and L.Sharpe.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1194-8 (Nov., 1955).

Ten naval personnel heard tape-recorded messages in control tower phraseologies over four channels. Any of four stations could be called over any channel. On three of the channels the operator controlled the playback of the messages by means of controls that allowed him to start and/or mute messages. The operator had no control over when the message came in over the fourth channel although he had provisions for muting it. The muting was used to silence messages that the subject was not required to respond to and was employed for one half of the test conditions. Each message contained twenty bits of information and was approximately five seconds long. In each half hour test session 378 messages were presented. Listening conditions ranged from having the operator respond to only one station with muting to answering three stations without muting. The results indicated slight but statistically significant increases in errors and in the times necessary to complete the jobs as the response task increased from one to three stations. Most errors occurred on the channel over which the operator had no sequencing control. For the message rates and density used in these experiments the operator could handle three stations with sequencing almost as accurately as he could handle one station without sequencing. A.

534.78

163. SIMULTANEOUS AND ALTERNATE LISTENING AND SPEAKING. E.C.Poulton.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1204-7 (Nov., 1955).

Listening and speaking simultaneously was compared with listening and speaking alternately. The presented message was masked by the subject's voice to approximately the same extent in the two cases. Results: the simultaneous condition gave more errors than the alternate condition. In learning to repeat back what they heard in the simultaneous condition, all subjects initially tried to repeat what they heard as they heard it. They thus made meaningless sounds, without being aware that they were doing so. A.

534.78

164. RELATIVE INTELLIGIBILITY OF SPEECH RECORDED SIMULTANEOUSLY AT THE EAR AND MOUTH. H.J.Oyer.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1207-12 (Nov., 1955).

Monosyllabic words recorded at the lips and left ears of six speakers were fed to the headsets of 24 trained listeners at −12, −15, and −18 S/N ratios. Although the trend for intelligibility scores throughout the test is in the same direction for signals of both origins, decreasing S/N ratio is more destructive to the speech picked up at the lips. A.

534.78

165. EFFECTS OF TRAINING ON LISTENERS IN INTELLIGIBILITY STUDIES. H.M.Moser and J.J.Dreher.
J.Acoust. Soc. Amer., Vol. 27, No. 6, 1213-19 (Nov., 1955).

Six hundred English monosyllables formed by successive agglutination of initial consonants were presented in high noise to twelve subjects skilled in listening in noise but uninformed as to the words. Alternate training and testing sessions were conducted at weekly intervals following this initial test and differential responses to the words were plotted. Results indicate that correct response is inversely proportional to the number of speech sounds in the monosyllable, with one exception: the two-sound monosyllable is superior to all other lengths when subjects have had even one chance to hear words read aloud. Responses grow progressively better, apparently becoming asymptotic to a ceiling value determined by the S/N ratio, at the same time preserving the same order of difference as established by the naive group. PB lists now in current use in audiology are analysed according to phonetic length and a method for correcting internal inconsistencies in lists is proposed. Amount and kind of listener training is seen as a primary variable in intelligibility testing. A.

534.79

166. RATING SCALE METHOD FOR COMPARATIVE LOUDNESS MEASUREMENTS. W.C.Michels and B.T.Doser.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1173-80 (Nov., 1955).

A recently developed method for the use of comparative rating scales in psychophysical measurements has been applied to loudness judgments. It is found that the theoretical predictions are verified to within the experimental accuracy but that the method is subject to certain limitations, which prevent complete verification of the theory. The values of the various undetermined parameters which enter into the prediction of judgments have been determined. It is found that the self-adaptation in hearing is large (80^{m}), and that the effects of residual stimuli and of other stimuli than the standard or the stimulus being judged are extremely small. A.

534.83 : 614.892

167. DESIGN AND TESTING OF EARMUFFS. J.Zwislocki.
J.Acoust. Soc. Amer., Vol. 27, No. 6, 1154-63 (Nov., 1955).

Factors controlling the sound attenuation provided by earmuffs are analysed and an upper limit is estimated of the attenuation that can be expected from simple earmuffs without sacrificing comfort. Further discussion concerns the best dimensions of the earmuff and what can be achieved by adding one or more Helmholtz resonators. The sound attenuation provided by two different earmuffs was determined on eight subjects in three sessions with a Bekesy audiometer. The experimental procedure is described in detail and the results are analysed statistically. Special attention has been paid to the changes in the listener's threshold of audibility with increasing experience. A.

534.843 : 534.833

168. STUDY OF ACOUSTICAL REQUIREMENTS FOR TEACHING STUDIOS AND PRACTICE ROOMS IN MUSIC SCHOOL BUILDINGS. R.N.Lane and E.E.Mikeska.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1087-91 (Nov., 1955).

Acoustical measurements are presented on rooms of several music buildings located at four southwestern universities. Data were taken on a wide range of wall construction and recommendations on room response and acoustical isolation between rooms are presented. A.

534.845

169. ACOUSTICAL PROPERTIES OF CARPET. C.M.Harris.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1077-82 (Nov., 1955).

The acoustical properties of carpet are of interest in the design of auditoriums and studios, since the absorption which it contributes may be quite significant. However, little data exist on the acoustical properties of carpet and the scanty data available make no distinction among the various types of carpet. This paper describes measurements of the normal absorption coefficient and flow resistance for a wide variety of carpet samples. The normal absorption data were used to investigate which of many variables in carpet construction are important from the standpoint of acoustical absorption. On the basis of these data, certain key samples were selected for chamber test at the National Bureau of Standards for comparison with the tube measurements. A.

534.862.3

170. SYNCHRONIZATION OF MUSIC ON DUAL TAPES. A. G. Pikler.
J. Acoust. Soc. Amer., Vol. 27, No. 5, 974-5 (Sept., 1955).

Revitalizing of old non-electric disk recordings and the addition of accompaniments to recordings have been effected in the past by some method of superposition. A method of juxtaposition reduces the difficulties associated with cueing, feedback, etc. Two magnetic tracks are employed. The original recording is transferred to the first track. This is then played back at a moderate level to the performer who records his part on the second track. The technique enables stereophonic effects to be introduced. Other applications, including those associated with psychological studies, are suggested. H. G. M. Spratt

OPTICS. RADIATION. SPECTRA 535

535.14

171. OBSERVATIONS ON COHERENT LIGHT WITH A PHOTOMULTIPLIER. A.Ádám, L.Jánossy and P.Varga.
Ann. Phys. (Leipzig), Vol. 16, No. 5-8, 408-13 (1955). In German.

An experiment is described which indicates that the photons in coherent light beams have no correlation with each other. Coherent beams are produced at a semireflecting mirror and fall on the cathodes of photomultipliers whose outputs are fed to coincidence counters. The number of coincidences with coherent light is not significantly different from the number with incoherent light. See also Abstr. 7803 (1955). R.W.Fish

535.223

172. IMPROVED VALUE OF THE VELOCITY OF LIGHT DERIVED FROM A BAND SPECTRUM METHOD. D.H.Rank, H.E.Bennett and J.M.Bennett.
Phys. Rev., Vol. 100, No. 4, 993 (Nov. 15, 1955).

The previously reported value of the velocity of light as obtained from B'' of the 002 band of HCN has been improved as a result of an absolute interferometric wavelength determination of the band origin. The new value, 299 791.9 ± 2.2 km/sec, is in good agreement with that obtained from all other modern methods. A

535.231.2

173. BLACKBODY RADIATION AND LAMBERT'S LAW. M.A.Melvin.
Amer. J. Phys., Vol. 23, No. 8, 508-10 (Nov., 1955).

It is demonstrated by a general argument, using the property of isotropic intensity characteristic of cavity radiation, that the emissive radiance from the surface of a blackbody is Lambertian. A.

535.241

174. BRIGHTNESS METER FOR STREET LIGHTING. J.B. de Boer.
Lichttechnik, Vol. 7, No. 7, 273-5 (July); No. 8, 307-9 (Aug., 1955). In German.

Describes a visual instrument designed for measuring the luminance of a street in situ. Considerations of perspective show that the area measured must be about 2 min of arc high and 8.5 min wide. A small field results in lack of sensitivity and in this instrument the field is magnified ten times by the ocular. The range covered is 0.01 to 10^6 cd/m^2. The lamp is controlled by voltmeter. Colour filters for Na and Hg lighting are provided. J. W. T. Walsh

535.241.14

175. THE SUITABILITY OF POLARIZING FILTERS FOR PHOTOMETRIC MEASUREMENTS. K.D.Mielenz.
Optik, Vol. 12, No. 11, 513-25 (1955). In German.

A theoretical discussion of various optical systems with polarizing filters, as used in existing photometers. An index of efficiency for the filter may be obtained from a ratio, R, which involves the observed transmissions for parallel, and perpendicular, components of a plane-polarized-ray incident on the filter, viz. $R = \left[(T_{||} \times T_{\perp})/(T_{||} - T_{\perp})^2\right]$. The smaller the numerical value of R, the more efficient is the filter. Values of R for three different types range from 2.7×10^{-2} to 2.9×10^{-6}; and for two of these a wavelength dependence is found. D.R.Barber

535.242.43 : 535.33.07

176. ROTATING STEP-SECTOR FOR USE WITH A.C. OR OTHER INTERMITTENT SPECTROGRAPHIC LIGHT SOURCES. R.N.Kniseley and V.A.Fassel.
J. Opt. Soc. Amer., Vol. 45, No. 12, 1032-4 (Dec., 1955).

The calibration of the response of photographic emulsions using rotating step-sectors may lead to erroneous results when intermittent spectrographic light sources are used. These errors arise through partial synchronization between the periodicity of the light pulses and the passage of sector apertures in front of the spectrograph slit. A design for a rotating step-sector which should overcome synchronization possibilities has been conceived and some actual sectors have been tested. This sector essentially consists of a series of stepped apertures randomly spaced about the periphery of a rotating disk. Data are presented to show that the random spacing of the sector apertures eliminates the possibilities of introducing errors through synchronization effects when conventional intermittent discharges are used. A.

535.242.63

177. AN APPROXIMATE CALCULATION OF FILTER ERRORS. G.Hansen.
Optik, Vol. 12, No. 11, 497-502 (1955). In German.

The determination of absorption coefficients with photometers equipped with filters suffers errors from the impurity of the light. An approximate method of correction is described based upon a power series variation of the extinction coefficient within the spectral band passed by the filter. R.W.Fish

535.242.63

178. THE PROOF OF AN APPROXIMATE FORMULA FOR THE CALCULATION OF FILTER ERRORS. E.Asmus and H.Wunderlich.
Optik, Vol. 12, No. 11, 503-12 (1955). In German.

The errors arising from the use of filters with finite spectral range when measuring extinction coefficients can be corrected by making assumptions regarding the variation of the coefficient with wavelength. The method of calculation and the results of comparative practical measurements are given in detail. The correction is shown to leave residual errors smaller than experimental errors. R.W.Fish

535.243

179. SPECTROPHOTOMETRY OF FLUORESCENT LAMPS USING FILTERS. E. Rohner.
Bull. Assoc. Suisse Elect., Vol. 46, No. 12, 567-71 (June 11, 1955). In German.

Describes a method of abridged spectrophotometry of fluorescent lamps by the use of interference filters. These have transmission bands some 30 to 40 millimicron in width, and by the use of ten filters, with two photocells having more or less complementary spectral sensitivity curves, good agreement with the results found by accurate spectrophotometry can be obtained. J. W. T. Walsh

535.245.22

180. INTEGRATING SPHERE FOR THE MEASUREMENT OF REFLECTANCE WITH THE BECKMAN MODEL DR RECORDING SPECTROPHOTOMETER. J.A.Jacquez, W.McKeehan, J.Huss, J.M.Dimitroff and H.F.Kuppenheim.
J. Opt. Soc. Amer., Vol. 45, No. 11, 971-5 (Nov., 1955).

The design and performance of a comparison type integrating sphere is described. This instrument allows the measurement of total reflectance with an accuracy of about 1%. A.

535.247.4 : 551.521.326

181. AUTOMATIC PHOTOMETERS FOR THE STUDY OF THE NIGHT-SKY LIGHT. D.Barbier.
Rev. Opt., Vol. 34, No. 7-8, 353-60 (July-Aug., 1955). In French.

Since the various emissions that constitute the night airglow together produce an intensity equal to about 10^{-8} x that of the day sky, special instrumentation is needed to measure these. The problems are discussed relative to choice of techniques and available automatic recording instruments, including the new automatic photometer installed at the Haute-Provence observatory (see abstract following). D.R.Barber

535.247.4 : 551.521.326

182. A PHOTOMETER FOR THE NIGHT-SKY LIGHT. A.Baillet.
Rev. Opt., Vol. 34, No. 7-8, 361-4 (July-Aug., 1955). In French.

A detailed description is given of a photoelectric photometer, with a photomultiplier tube as receiver, which is able to record automatically light-intensities in 8 spectral regions from ultraviolet to far red. The cycle of operation is 5 min. D.R.Barber

535.31 : 535.12

183. A THEOREM ON WAVE SURFACES IN GEOMETRIC OPTICS. (Théorème sur les surfaces d'onde en optique géometrique.) R.Damien.

Paris: Gauthier–Villars (1955) 34 pp. In French.

The theorem relates the wave surfaces before and after reflection or refraction with the reflecting or refracting surface and its inverse. This applied to numerous standard cases, cardiods, hyperboloids, hyperbolic spirals etc.

R.W.Fish

535.317 : 518.5

184. ON THE AUTOMATIC DESIGN OF OPTICAL SYSTEMS. G. Black.

Proc. Phys. Soc. B, Vol. 68, Pt 10, 729-36 (Oct., 1955).

Electronic digital computers in Britain and the U. S. A. have been used for the tracing of rays at high speeds through optical systems. The larger machines have enough auxiliary storage, either magnetic drum or tape, to accommodate enormous amounts of information so that it is possible to carry out extensive numerical investigations concerning lens systems. This paper deals with machine methods of minimizing the calculated geometrical aberrations of systems in much the same way as the optical designer using conventional desk machines. It will be shown that the main designer's task can be achieved automatically in a remarkably short time. The machine referred to is the Manchester Electron Computer (MADAM), but the remarks apply to any high-speed machine with a reasonable storage capacity. It is not proposed to enter into any of the programming details, these would require a separate paper. A.

535.317.1

185. INFLUENCE OF THE COHERENCE OF THE ILLUMINATION ON THE CONTRAST OF THE IMAGE OF A BLACK POINT IN THE PRESENCE OF A SMALL DEFECT OF FOCUS. S.Slansky.

Optica Acta, Vol. 2, No. 3, 118-25 (Oct., 1955). In French.

The contrast of the image of a black point on a white background is studied as a function of the ratio $p = b/a$ of the numerical aperture of the illuminating system to that of the imaging system. For $p = 1$ or less, for a perfectly stigmatic instrument the contrast is, to a first approximation, independent of p and equal to the contrast with coherent illumination; In the presence of a small defect of focus the contrast varies with p, and attains a maximum in the region of $p = 0.87$. For p greater than 1, the contrast decreases and tends toward the value for incoherent illumination, which is about one half that obtained for $p = 1$. A.

535.317.25

186. THE THEORY OF RESOLVING POWER. A.Kranjc.

Mem. Soc. Astron. Ital., Vol. 26, No. 3, 349-50 (1955). In Italian.

A brief discussion of the theoretical basis for the usual Rayleigh definition of resolving power. This is said to depend upon the contrast sensitivity of the eye, which is unsatisfactory. Modern information theory may give a more satisfactory definition in terms of "noise" in the photons forming the image.

R.W.Fish

535.317.3/.4

187. CONTRIBUTION TO THE STUDY OF THE STATE OF CORRECTION OF A KELLNER EYEPIECE. J. Barcala and D. Vázquez.

An. Real. Soc. Españ. Fís. Quím., Vol. 51 (A), No. 7-8, 159-62 (July-Aug., 1955). In Spanish.

Equations are derived for the focal lengths of eye lens and field lens for a given separation and eye position. The aberrations are calculated for one example and curves are drawn connecting the aberrations and the variables. R. W. Fish

535.317.5

188. NOTE ON THE COMPUTATION OF THIRD-ORDER ABERRATIONS. J.L.Rayces.

J.Opt. Soc. Amer., Vol. 45, No. 11, 999-1000 (Nov., 1955).

The Seidel aberration coefficients of imagery in a system of centred spherical refracting surfaces are computed with equations based upon the constants of the optical system and the variables of paraxial imagery. The equations are presented in a form convenient for use with a desk calculator. All the factors are found through the evaluation of a second-order determinant. R.W.Fish

535.317.5

189. A NOTE ON THE AUTOMATIC CORRECTION OF THIRD-ORDER ABERRATIONS. C.A.McCarthy.

J. Opt. Soc. Amer., Vol. 45, No. 12, 1087-8 (Dec., 1955).

Equations have been obtained connecting the changes in third-order aberration coefficients with changes of curvature of the lens radii. When more degrees of freedom exist than aberration coefficients, a further condition is suggested making the sum of the squares of the changes of curvature a minimum. A computing procedure is indicated, which with IBM machines allows a solution for 8 surfaces to be obtained in 2½ minutes. R.W.Fish

535.317.6

190. ON A SET OF CLASSICAL METHODS FOR THE COMPUTATION OF OPTICAL SYSTEMS. F.I.Havliček.

Optica Acta, Vol. 2, No. 3, 126-7 (Oct., 1955).

Starting from Gaussian optics, Petzval sum and a first criterion for low distortion for the first layout, there are foreseen three steps in the calculation of the system. In the first there is combined a Seidel approximation for thin lenses introducing Argentieri's coefficients, with an analysis for a thick system following Berek's method. Iteration of these two methods with slide rule accuracy gives the starting point for the next higher stage of correction of the system of thick lenses. In the next step a variation method of Seidel coefficients leads with parallel trigonometrical checks to the final stage of correction. In the last step control of the results obtained with the former methods is introduced by using an analysis of the wavefront. A.

535.323

191. DISPERSION OF THE REFRACTION OF SOME CUBIC CRYSTALS. G.Poinsot and J.P.Mathieu.

Ann. Phys. (Paris), Vol. 10, 483-6 (July-Aug., 1955). In French.

The refractive indices between 0.3 and 0.77 micron are measured for the NH_4Cl, $NaBrO_3$, $Sr(NO_3)_2$, $Ba(NO_3)_2$ and $Pb(NO_3)_2$. Constants are found for the Drude formula and experimental values are compared with those calculated.

R.W.Fish

535.323

192. OPTICAL PROPERTIES OF CESIUM IODIDE. W.S.Rodney.

J. Opt. Soc. Amer., Vol. 45, No. 11, 987-92 (Nov., 1955).

The refractive indices of CsI were determined at three temperatures near 15, 24 and 34° C for wavelengths from 0.29 micron in the ultraviolet to 53 microns in the infrared. The thermal coefficients of index were determined for each wavelength and all data were reduced to 24° C. A dispersion equation of the Sellmeier type having five terms was fitted to these data. Four of the terms contained absorption wavelengths which were either known experimentally or had been computed from the lattice constants of the crystal. The fifth was adjusted to fit the data and has a value of about 0.02 micron. The formula was extrapolated to infinite wavelength, and the value of n_∞^2 agreed with the known dielectric constant at 30 cm. The dispersion of CsI for infrared wavelengths from about 30 to 40 microns is less than that of CsBr but only by a factor of about 2. At 50 microns the dispersion of CsI is practically equal to the 40 micron dispersion of CsBr. A.

535.323 : 535.345 : 535.39 : 531.717

193. SIMULTANEOUS MEASUREMENT OF THE OPTICAL CONSTANTS AND THICKNESS OF VERY THIN SILVER FILMS IN THE VISIBLE AND NEAR ULTRAVIOLET PARTS OF THE SPECTRUM. R.Philip and J.Trompette.
C.R. Acad. Sci. (Paris), Vol. 241, No. 8, 627-9 (Aug. 22, 1955). In French.

Measurements were made on evaporated silver films of thicknesses ranging from 0.65 to 72.2 millimicron (thickness t measured by mass). At high values of t there is good agreement between the optical and gravimetric data. Optical constants were measured for 8 wavelengths between 3021 and 5780 A. R.A.Weale

535.33.03

194. PULSE TECHNIQUES IN MICROWAVE SPECTROSCOPY. R. H.Dicke and R. H. Romer.
Rev. sci. Instrum., Vol. 26, No. 10, 915-28 (Oct., 1955).

Methods are described for exciting gases to states from which they emit coherent spontaneous radiation in the microwave frequency region. The excitation is produced by the application of short pulses of microwave power. The power subsequently radiated by the gas is calculated for several cases, and experimental methods used to detect the radiation are described. The problem of sensitivity is discussed and compared to the sensitivity obtainable in a continuous absorption experiment. The operation of a high resolution microwave spectrometer, which produces lines substantially narrower than the usual Doppler width, is described. The method used to stabilize the klystron used in these experiments, which is a modification of the Pound i.f. method, is given. A.

535.33.03

195. THE HIGH-PRESSURE XENON ARC AS A STANDARD SOURCE OF RADIATION. T.Heller.
Z. Astrophys., Vol. 38, No. 1, 55-72 (1955). In German.

When used with an electronic stabilizing circuit the Xe high-pressure arc, operating at 200 V d.c., provides a convenient and reproducible source of continuum in the spectral range 3700 to 5300 A, with a long working life (about 500 hr). Throughout this period, fluctuation of colour-temperature ($5572 \pm 33^{\circ}$K) is found not to exceed 2%. Between 3500 and 4500 A, the Xe source is relatively more intense than the C arc. D.R.Barber

535.33.03

196. NEW KRYPTON LIGHT SOURCE FOR THE VACUUM ULTRAVIOLET. P.G.Wilkinson.
J. Opt. Soc. Amer., Vol. 45, No. 12, 1044-6 (Dec., 1955).

A light source is described which emits a continuous spectrum from 1250 to 1650 A. The electrodeless source, charged with 190 mm of krypton, is operated with microwave power at 2450 Mc/s, and is completely sealed off from the pumping system. It has been used with a 21 ft vacuum spectrograph to photograph the absorption spectrum of benzene vapour in the 1350 to 1550 A region. A.

535.33.03 : 536.46

197. SPECTRUM OF CARBON MONOXIDE—OXYGEN EXPLOSION. I. THE VISIBLE SPECTRUM. R.H.Knipe and A.S.Gordon.
J. chem. Phys., Vol. 23, No. 11, 2097-101 (Nov., 1955).

The effect of composition on the spectrum of the explosion of pure, dry CO and oxygen has been studied. In addition to the expected continuum with a superposed banded emission, a banded absorption has been observed. The absorber is probably the $a(^3\Pi_r)$ state of CO. The possibility that this excited state of CO is important in the production of the continuum is discussed. A.

535.33.07

198. CHOICE OF STANDARDS AND METHODS OF GRADUATION OF PRISM INFRARED SPECTROMETERS. A.N.Aleksandrov and V.A.Nikitin.
Uspekhi fiz. Nauk, Vol. 56, No. 1, 3-54 (1955). In Russian.

The U.S.S.R. now has three i.r. spectrometers (IKC - models 11, 6, 2) in series production and these are widely used in industry as well as in a wide variety of other labs. The paper gives a first-class review of the theoretical background of a large-scale and important practical problem. Useful tables are given showing the working ranges of various prism materials and also absorption spectra suitable for calibration purposes. Methods of using results for calibration due to Martin, Hartmann, McKinney and Friedel, are discussed. There is a brief account of the effect of temperature and of the interchange of prisms. An appendix deals in conventional fashion with the resolving power of a spectrometer prism, wave-numbers in vacuo, the scattering of light in instruments. 41 refs., the majority post - 1950. C.R.S.Manders

535.33.07

199. MEASUREMENT OF NEARBY STRAY RADIATION IN ULTRAVIOLET SPECTROPHOTOMETERS. D.D.Tunnicliff.
J. Opt. Soc. Amer., Vol. 45, No. 11, 963-5 (Nov., 1955).

A method has been devised for testing ultraviolet monochromators for nearby stray radiation i.e., the stray radiation with wavelengths close so that of the dispersed radiation. The method is based on the observed transmittance of the very narrow 2537 A absorption peak of saturated mercury vapour at elevated temperatures. The usual method of determining stray radiation does not detect nearby stray radiation because the peak normally used for the measurement is so broad as to absorb this radiation. Nearby stray radiation is particularly objectionable in the recording of absorption spectra of the very sharp peaks observed at low temperature and in the spectra of vapours. A.

535.33.07

200. MEASUREMENT OF SOLID SAMPLES ON THE CARY SPECTROPHOTOMETER. G.M.Wyman.
J. Opt. Soc. Amer., Vol. 45, No. 11, 965-6 (Nov., 1955).

A simple adapter has been constructed for the cell compartment of the Cary spectrophotometer in order to permit the measurement of the spectra of solid samples (in the form of KBr pellets) in the ultraviolet and visible regions. This technique has been found useful for measuring the spectra of insoluble dyes and pigments. In the case of soluble compounds, examples are presented to show how a comparison of the spectrum in the solid phase with the spectrum of the solution can provide valuable information concerning the structure and configuration of the compound in the solid state. A.

535.332

201. FINE STRUCTURE OF SINGLY IONIZED HELIUM. R.Novick, E.Lipworth and P.F.Yergin.
Phys. Rev., Vol. 100, No. 4, 1153-73 (Nov. 15, 1955).

The energy difference (d) between the $2\,^2S_{1/2}$ and $2\,^2P_{1/2}$ states of ionized helium has been measured by a pulsed microwave method. Helium atoms are excited to the metastable $2\,^2S_{1/2}$ state of the ion by a microsecond pulse of electrons of about 250 eV energy. After bombardment and after the atoms and ions excited to nonmetastable states have decayed to their respective ground states, a pulse of microwave power is applied to induce the $2\,^2S_{1/2} - 2\,^2P_{1/2}$ transition. This transition is followed immediately by spontaneous emission of a 40.8 eV photon associated with the $2\,^2P_{1/2} - 1\,^2S_{1/2}$ transition. The photons are observed by counting photoelectrons with high-speed counters gated on synchronously with the pulses of microwave power. Two different levels of r.f. power are used alternately to provide a means of normalizing the data for variations in the population of the $2\,^2S_{1/2}$ state. The value of d for He^+ was found to be $14\,043 \pm 13$ Mc/s. The stated uncertainty is equal

to three times the standard deviation plus an estimated 3 Mc/s for the uncertainty in the corrections for systematic effects. This result, consistent with previous results, is in agreement with the best available theoretical value of 14043.2 ± 3.0 Mc/s. A.

535.332

202. INTERFERENCE MEASUREMENTS IN THE INFRARED SPECTRUM OF NEON. S.A.Sullivan.
J. Opt. Soc. Amer., Vol. 45, No. 12, 1031-2 (Dec., 1955).

To aid in establishing neon standards in the infrared, interference measurements of 23 lines in the 7059 A-8865 A region are reported. The wavelengths were compared with the neon standards in the yellow-red region. Etalons of 3.75, 7.45, 10, 15 and 25 mm were used with a Fabry–Perot interferometer. The close consistency of the measurements with the results of Meggers and Humphreys and of Burns, Adams, and Longwell suggest the suitability of these wavelengths as secondary standards. A.

535.332 : 537.523.5

203. THE MEASUREMENT OF THE OSCILLATOR STRENGTH OF SEVERAL NI LINES IN WATER- AND AIR-STABILIZED ARCS. H.Motschmann.
Z. Phys., Vol. 143, No. 1, 77-92 (1955). In German.

From measurements of line intensities in water-wall and other arcs, the oscillator strength of 10 line groups of NI were deduced. Comparison is made with theory, both for relative and absolute measurements. The measurements are discussed in relation to the physics of arcs (temperatures etc.). Some reference is also made to certain OI lines. J.D.Craggs

535.333 : 539.132

204. ROTATIONAL ANALYSIS OF THE CrO BANDS. M.Ninomiya.
J. Phys. Soc. Japan., Vol. 10, No. 10, 829-36 (Oct., 1955).

The (0, 1), (0, 0) and (1, 0) bands of CrO, which appear in the red and yellow region, are analysed rotationally, and it has been shown that these bands are due to the transition $^5\Pi - ^5\Pi$. The theoretical formulae for the quintet state and the molecular constants have been obtained. A.

535.333

205. THE EMISSION SPECTRA OF WATER AND HEAVY WATER. S.Leach.
J. Chim. phys., Vol. 52, No. 6, 492-7 (June, 1955). In French.

Discusses band systems in the emission spectra of H_2O, D_2O and HDO in which such ions as OH^+, OH^- etc. and such radicals as OH, OD are of importance. The results, amongst other things, give information on the electron affinity of O. The author discusses Schüler's spectroscopic value of 0.65-0.95 eV and the electron impact value of 2-3 eV approx. His interpretations favour the latter. J.D.Craggs

535.337

206. STARK FIELDS FROM IONS IN A PLASMA. A.A.Broyles.
Phys. Rev., Vol. 100, No. 4, 1181-7 (Nov. 15, 1955).

A method is described here for determining the probability of obtaining a given electric field on an ion in a plasma. This quantity is essential for computing the broadening of spectral lines from neighbouring ions and therefore for their contributions to the opacity. The Pines-Bohm method of separation into long-range Coulomb interactions has been employed. It is argued that the formulae give the line width for iron at one kilovolt and normal density to ± 3%. A.

535.338.32

207. ABSORPTION OF SODIUM BY GLASS WALLS HEATED TO 120° C. J.Brossel, J.L.Mosser and M.Winter.
J. Phys. Radium, Vol. 16, No. 10, 814-15 (Oct., 1955). In French.

It is found that, even at a temperature as low as 120° C, the gradual absorption of Na vapour on glass walls of an optical cell can increase the resonance emission by up to 30% over a period of 50 hours. Hence great care must be exercised in interpreting resonance measurements made on alkali vapours. R.O.Davies

535.338.32

208. RESONANCE IRRADIATION OF MERCURY VAPOR IN NITROGEN. J.A.Berberet and K.C.Clark.
Phys. Rev., Vol. 100, No. 2, 506-16 (Oct. 15, 1955).

A study has been made of phenomena related to the metastable 6^3P_0 mercury atom appearing in a cell which contains nitrogen and saturated mercury vapour at 22° C and is irradiated with 2537 A ($6^1S_0 - 6^3P_1$) resonance emission from a cool mercury arc. Various phenomena reported individually by many investigators are observed simultaneously and with improved techniques so that coherent correlations can be drawn and new conclusions developed. The relative 6^3P_0 population produced from 6^3P_1 atoms by inelastic collision is measured by self-absorption of 4047 A ($6^3P_0 - 7^3S_1$); its dependence upon 2537 A intensity is linear and its dependence upon nitrogen pressure is given by theory. The 6^3P_1 population is quenched by nitrogen. With conditions of high gas purity it is possible to produce large currents of heavy ions, the probable mechanism being a three-body collision between 6^3P_0, 6^3P_1 and N_2 to form a highly excited molecule, which becomes ionized in a subsequent step. The ion formation is a volume process, varying with the second power of the 2537 A intensity. The continuum intensity near 4850 A is linear with 2537 A intensity and shows a pressure dependence consistent with molecular formation in a three-body collision between 6^3P_0, 6^1S_0 and N_2. Mean lifetimes of metastable population, ion formation and continuum intensity are measured as a function of pressure of nitrogen. They are found to differ distinctly, being generally larger in the order named. At high irradiation intensity an ion current of 405 microamp was observed, leading to a prediction that several percent of the mercury atoms could be in the metastable state. A.

535.338.333

209. THE ISOTOPE EFFECT IN ATOMIC SPECTRA. A.R.Striganov and Yu.P.Dontsov.
Uspekhi fiz. Nauk, Vol. 55, No. 3, 315-90 (1955). In Russian.

For convenience 55 elements, ranging from H to Am, are considered in three groups, light, medium and heavy. Each section gives an account of theory and experimental results are given in numerous tables and a considerable number of sketches of line structures. The "heavy" section includes well-balanced discussions of the theory of the volume effect, the effect of deformation of the nucleus, perturbations of configuration. 220 refs. C.R.S.Manders

535.338.333

210. ISOTOPE SHIFT IN THE FIRST SPECTRUM OF ATOMIC LITHIUM. R.H.Hughes.
Phys. Rev., Vol. 99, No. 6, 1837-9 (Sept. 15, 1955).

The isotope shift in Li I has been studied in the hollow cathode spectrum from separated isotopes with the aid of a Fabry–Perot interferometer. Specific shifts have been determined for the 2s, 2p, 3s, 3p, 3d, 4s, 4d, 5s and 5d levels. The inadequacy of the Hughes–Eckart approximation is pointed out. A.

535.338.333

211. ISOTOPE SHIFT IN THE FIRST THREE SPECTRA OF BORON. E.W.Burke, Jr.
Phys. Rev., Vol. 99, No. 6, 1839-41 (Sept. 15, 1955).

Isotope shifts have been observed in the first three spectra of boron, with separated isotopes. Results are given on the assumption that the total observed shift consists

only of the (exactly calculable) normal mass effect and a specific mass effect. A.

535.338.333 : 539.152.2

212. INVESTIGATION OF THE HYPERFINE STRUCTURE OF THE SPECTRA OF PLUTONIUM AND OF URANIUM ISOTOPES. N. I. Kaliteevskiĭ and M.P. Chaĭka.
Dokl. Akad. Nauk SSSR, Vol. 103, No. 1, 49-51 (1955). In Russian.

Spectra were excited in a gas-discharge tube with a hollow water-cooled cathode, using a Fabry—Pérot etalon to obtain high resolving power. The spin values found were $I(U^{233}) = 5/2$, $I(U^{235}) = 5/2$ or perhaps 7/2, $I(Pu^{239}) = \frac{1}{2}$, in agreement with values obtained by other workers. The violation of the interval rule for certain levels of the uranium isotopes was ascribed to the presence of quadrupole moments. On this hypothesis, the ratio of the magnetic moments of these was found to be -1.8 ± 0.1 for either spin of U^{235}, and the ratio of quadrupole moments to be 2.0 ± 0.3 if $I(U^{235}) = 5/2$. J. B. Sykes

535.338.334

213. CONTOURS OF THE PASCHEN LINES OF THE HYDROGEN ATOM. G. Hepner.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 380-2 (July 25, 1955). In French.

Data on the line profiles, using a condensed discharge, give values for the normal interionic field either by comparison with the Stark profiles deduced from Holtsmark's theory, or by measurement of the line-width at half peak intensity. The values agree reasonably for the two methods, and for the α and β Balmer lines as well as the α and β Paschen lines. Disagreement with experiment arises from the theoretical methods of de Jager and Pannekoek. The electronic concentration is found to be 1.5×10^{16} per cm^3. S. T. Henderson

535.338.334

214. LINE BROADENING BY ELECTRONS: VALIDITY OF SIMPLE THEORIES. R.E. Meyerott and H. Margenau.
Phys. Rev., Vol. 99, No. 6, 1851-4 (Sept. 15, 1955).

A comparison is made between simple impact theories of line broadening by electrons (Weisskopf, Lindholm, Inglis and Teller, Unsöld) and recent more detailed quantum calculations by Kivel, Bloom and Margenau. A.

535.338.4

215. BAND WIDTHS IN THE SPECTRA OF MANGANOUS AND OTHER TRANSITION-METAL COMPLEXES. L.E. Orgel.
J. chem. Phys., Vol. 23, No. 10, 1824-6 (Oct., 1955).

The spectrum of the hydrated manganous ion is interpreted in detail and the factors influencing the widths of the bands are deduced. The band widths in other transition-metal spectra are shown to be explicable in the same way. A.

535.342/.343

216. CONTRIBUTION TO THE STUDY OF THE INTENSITY AND THE WIDTH OF INFRARED ABSORPTION LINES. J. Vincent-Geisse.
Ann. Phys. (Paris), Vol. 10, 693-737 (Sept.-Oct., 1955). In French.

Previous theoretical considerations (Abstr. 6909/1955) are tested experimentally by measurements on rotation-vibration bands. For CH_4 there is some discrepancy between the relative intensities of the rotational lines of a band and the expected distribution and reasons for this are suggested; agreement is good for bands of CO and NO. Line widths deduced from the intensities are smaller than those found by others but agree with simple considerations of molecular collisions. The effective slit width, which needs to be known, is found from the minimum width which causes a known rotational structure to disappear. G.F. Lothian

535.343

217. REGULARITIES IN THE ABSORPTION SPECTRA OF HALIDES. L.I. Katzin.
J. chem. Phys., Vol. 23, No. 11, 2055-60 (Nov., 1955).

Original absorption spectra of halides and a large body of literature absorption spectrum data are assembled. Certain characteristic features are pointed out which can be ascribed to transitions of electrons localized on the halide portion of a molecule or ion, such that their removal to an excited condition essentially leaves a neutral halogen atom as part of the excited state configuration. Recognition of this portion of the spectrum should assist understanding of halide spectra. A.

535.343

218. ABSORPTION SPECTRUM OF COPPER IODIDE AT LOW TEMPERATURES. S. Nikitine, L. Couture, G. Perny and R. Reiss.
C.R. Acad. Sci. (Paris), Vol. 241, No. 8, 629-31 (Aug. 22, 1955). In French.

Thin layers of CuI at low temperatures show doublet absorption line series of hydrogen-like form which are attributed to exciton formation. G. F. J. Garlick

535.343

219. OPTICAL ABSORPTION SPECTRUM OF MgO BY REFLECTIVITY. J.R. Nelson.
Phys. Rev., Vol. 99, No. 6, 1902-3 (Sept. 15, 1955).

Bands at 930, 1120 and 1640 A are found and their origin is discussed. G.F. Lothian

535.343

220. ULTRAVIOLET ABSORPTION SPECTRA OF URANIUM GLASSES. K. Osada.
J. Phys. Soc. Japan, Vol. 10, No. 9, 825-6 (Sept., 1955).

Two specimens show single absorption maxima at 230 and 260 millimicron which are attributed to uranyl and uranate groups respectively. Differences in fluorescence of the two are described qualitatively. G.F. Lothian

535.343

221. NEAR ULTRAVIOLET ABSORPTION SPECTRA OF ORTHO-, META- AND PARA-PHENYLENEDIAMINE VAPORS. A. Sadō and T. Anno.
J. chem. Phys., Vol. 23, No. 9, 1740-1 (Sept., 1955).

A band system for the meta-form near 3000 A is analysed and vibrational frequencies compared with those of the Raman spectrum. G. F. Lothian

535.343

222. ABSORPTION SPECTRA OF LUMINESCENT THALLOUS CHLORIDE SOLUTIONS. A.B. Scott and K.-H. Hu.
J. chem. Phys., Vol. 23, No. 10, 1830-3 (Oct., 1955).

The absorption spectra of solutions of KCl, made luminescent by the addition of TlCl, have been analysed with the assistance of dissociation constants for TlCl and $TlCl_2^-$ obtained from solubility measurements. Absorptivities for each of the absorbing species have been found at several wavelengths. Spectra of solutions having a wide variety of KCl and TlCl concentrations were calculated from the absorptivities and dissociation constants; these agree quite well with the observed spectra except at high Cl^- concentration, where the disagreement is ascribed to the formation of more highly coordinated complexes. Decrease of dielectric constant of the solvent shifts the absorption band in the direction to be expected from an increase in the stability of molecular TlCl and the complex ions. A.

535.343

223. POLARIZED SPECTRA OF ANTHRACENE CRYSTALS AND DAVYDOV SPLITTING. L.E. Lyons.
J. chem. Phys., Vol. 23, No. 10, 1973 (Oct., 1955).

The predictions of Craig and Hobbins (Abstr. 5322/1955) are experimentally confirmed. The absorption system

A_g–B_{3u} has a b-component at 2680 A_0 and an a-component at 1890 A (predicted splitting 16 000 cm^{-1}). The molar extinction coefficient is 9450, agreeing with the theoretical value of 9100 ± 500. C.Turner

535.343

224. ON THE INFRARED SPECTRUM OF H_2 INDUCED BY THE INTERMOLECULAR FIELD IN H_2–HCl MIXTURES AND IN PURE COMPRESSED H_2. R.Coulon, L.Galatry, J.Robin and B.Vodar.
J. Phys. Radium, Vol. 16, No. 8-9, 728-9 (Aug.-Sept., 1955). In French.

The expectation (Abstr. 5313/1955) that a polar gas (HCl or CO_2) will induce the absorption spectrum of H_2 is confirmed, and the assignment of the bands found is discussed. G.F.Lothian

535.343

225. ABSORPTION BANDS OF N_2O NEAR 4.5 μ. K.Lakshmi and J.H.Shaw.
J. chem. Phys., Vol. 23, No. 10, 1886-8 (Oct., 1955).

These bands have been remeasured. In addition to the intense lines of the ν_3 and $\nu_3 + \nu_2 - \nu_2$ bands, many new weak lines have also been observed and their frequencies determined. Although no band assignments could be made for these weaker lines, the molecular constants obtained from the other two bands agree well with the values reported by Thompson and Williams. A.

535.343

226. THE ν_3 INFRARED BAND OF AMMONIA. C.Cumming.
Canad. J. Phys., Vol. 33, No. 11, 635-9 (Nov., 1955).

An absorption band in gaseous ammonia at 3μ is observed at high resolution and attributed to the doubly degenerate fundamental ν_3. The constants ν_0 = 3442.9, $A_0 = A_1$ = 6.13, A_1 = 0.29, and B_1 = 9.75 cm^{-1} describe the band. Many of the observed lines are doublets. This doubling is a result of the inversion of the ammonia molecule and the value 1.1 cm^{-1} is calculated for the inversion doubling of the 0010 state. A.

535.343

227. ON THE FERMI RESONANCE AND ISOTOPE EFFECT IN THE INFRARED SPECTRUM OF CARBON TETRACHLORIDE. P.Tuomikoski.
J. chem. Phys., Vol. 23, No. 11, 2083-4 (Nov., 1955).

The influence of intermolecular (solvent) interactions on the Fermi resonance in a number of CCl_4 infrared absorptions has been examined; it is discussed together with the incidence of isotopic frequencies. A.

535.343

228. NEAR INFRARED SPECTRUM OF LIQUID DIBORANE. H.C.Beachell and E.J.Levy.
J. chem. Phys., Vol. 23, No. 11, 2168-70 (Nov., 1955).

The spectrum has been obtained between 4500 and 10 500 cm^{-1}. A complete assignment for the observed overtone and combination bands is presented. A.

535.343

229. INFRARED ABSORPTION OF LIQUID AND SOLID HYDROGEN WITH VARIOUS ORTHO-PARA RATIOS. W.F.J.Hare, E.J.Allin and H.L.Welsh.
Phys. Rev., Vol. 99, No. 6, 1887-8 (Sept. 15, 1955).

The band covering 4000-5500 cm^{-1} is shown for 25-100% para-H_2. It is concluded that Q_Q, $S_1(0)$ and $S_1(1)$ components for pure p-H_2 arise from quadrupole interaction, since their relative intensities accord with theoretical values for these interactions; but this agreement is no longer found in ortho-para mixtures. G.F.Lothian

535.343

230. ABSORPTION SPECTRA OF THE SOLID STATE. S. Nikitine.
J. Phys. Radium, Vol. 16, No. 7, 40 S - 41 S (July, 1955). In French.

A review, with particular mention of Cu_2O, of the nature of absorption in insulators and semiconductors arising in the regular lattice and at impurity centres. The properties of excitons are discussed. G. F. Lothian

535.343

231. INFRARED SPECTRA OF FERRITES. R. D. Waldron.
Phys. Rev., Vol. 99, No. 6, 1727-35 (Sept. 15, 1955).

The infrared spectra of seven ferrites of the formula M Fe_2O_4, where M designates a divalent metal, are presented and analysed. Electronic absorption was observed in the visible and near-infrared regions. Two absorption bands arising from interatomic vibrations were measured and force constants calculated for the stretching of bonds between octahedral or tetrahedral metal ions and oxide ions. These force constants are in agreement with the elastic and thermodynamic properties of these compounds and are sensitive to distribution of metal ions between the alternate sites. The integrated vibrational band intensities were measured: they are compatible with predominantly ionic bonding for these structures. A.

535.343

232. ON THE DOUBLET AT 13.8 μ IN THE INFRARED SPECTRUM OF POLYETHYLENE. R.Kaiser.
Naturwissenschaften, Vol. 42, No. 17, 483-4 (1955). In German.

The absorption of 20-micron thick films decreases with increase of temperature and with stretching, the effects in each case being greater for the shorter wave component. G.F.Lothian

535.343

233. VIBRATIONAL SPECTRUM OF 1-FLUORO-1-CHLOROETHYLENE. D.E.Mann, N.Acquista and E.K.Plyler.
J. chem. Phys., Vol. 23, No. 11, 2122-6 (Nov., 1955).

The infrared spectrum of gaseous FClC:CH_2 has been investigated in the range 1.6-52 . A satisfactory vibrational assignment has been achieved. The planar fundamentals occur at 3069, 3016, 1656, 1383, 1186, 947, 699, 432 and 371 cm^{-1}; the out-of-plane fundamentals are at 836, 607 and 515 cm^{-1}. A table of the thermodynamic functions for the ideal gas is given from 200 to 1500°K. A.

535.343 : 535.375.55

234. VIBRATIONAL SPECTRUM OF FLUOROTRICHLOROETHYLENE. D.E.Mann and E.K.Plyler.
J. chem. Phys., Vol. 23, No. 11, 1989-93 (Nov., 1955).

The infrared spectrum of gaseous fluorotrichloroethylene, FClC:CCl_2, has been obtained in the range 3-50 microns. The Raman spectrum of a liquid sample has also been determined. Earlier data and new force constant calculations for some other fluorochloroethylenes are reviewed and used to establish a satisfactory vibrational assignment for FClC:CCl_2. The planar fundamentals appear at 1645, 1181, 988, 857, 520, 407, 358, 250 and 174 cm^{-1}; the out-of-plane vibrations occur at 537, 313 and probably near 130 cm^{-1}. A necessary revision in the existing assignment for F_2C:CCl_2 is indicated. A table of the thermodynamic functions is given for FClC:CCl_2 in the ideal gaseous state. A.

535.343 : 538.615

235. TWO-QUANTUM TRANSITIONS IN THE MICROWAVE ZEEMAN SPECTRUM OF ATOMIC OXYGEN. V.W.Hughes and J.S.Geiger.
Phys. Rev., Vol. 99, No. 6, 1842-5 (Sept. 15, 1955).

Two-quantum transitions have been observed in the micro-

wave Zeeman spectrum of atomic oxygen in its ground $^3P_2$ state by the method of magnetic resonance absorption spectroscopy. The three lines observed originally by Rawson and Beringer are identified as arising from two-quantum transitions between Zeeman levels with the selection rule $\Delta M = \pm 2$. Each of the three lines is observed at the mean frequency of the two corresponding $\Delta M = \pm 1$ transitions to within the experimental accuracy of a few parts per million. The line width of the two-quantum transitions is approximately one-half that of the normal transitions, and the line intensity varies more rapidly with r.f. power, both in agreement with the theory. The principal features of these transitions are explained by second order time-dependent perturbation theory. The two-quantum transitions reported here are essentially similar to the double-quantum transition reported by Hughes and Grabner in the electric quadrupole spectrum of $Rb^{85}F$ and to the multiple-quantum transitions seen by Kusch in the Zeeman spectra of K and O_2. A.

535.343

236. NOTE ON THE X-BAND MICROWAVE SPECTRUM OF HEAVY WATER. D.W.Posener.
J. chem. Phys., Vol. 23, No. 9, 1728-9 (Sept., 1955).

A thorough search failed to disclose any D_2O absorption at 8884.83 Mc/s as reported by Crawford (Abstr. 1171/1954), and his line is ascribed to CH_2O derived from Glyptal resin. D.H.Whiffen

535.343 : 537.228.5

237. STARK EFFECT IN RAPIDLY VARYING FIELDS. S.H.Autler and C.H. Townes.
Phys. Rev., Vol. 100, No. 2, 703-22 (Oct. 15, 1955).

A method is developed for calculating the effects of a strong oscillating field on two states of a quantum-mechanical system which are connected by a matrix element of the field. Explicit approximate solutions are obtained for a variety of special cases, and the results of numerical computations are given for others. The effect of an r.f. field on the $J = 2 \rightarrow 1$ l-type doublet microwave absorption lines of OCS has been studied in particular both experimentally and theoretically. Each line was observed to split into two components when the frequency of the r.f. field was near 12.78 Mc/s or 38.28 Mc/s, which are the frequencies separating the $J = 1$ and $J = 2$ pairs of levels, respectively. By measuring the r.f. frequency, n_0, at which the microwave lines are split into two equally intense components, one may determine the separation between the energy levels. The measured value of n_0 depends upon the intensity of the r.f. field and the form of this dependence has been calculated and found to be in good agreement with the experimental results. A.

535.343

239. THE NUCLEAR QUADRUPOLE SPECTRUM OF 1.2.4.5 TETRACHLOROBENZENE. A.Monfils.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 561-2 (Aug.8, 1955). In French.

The spectrograph allowed measurement of frequencies at various temperatures (77°–294°K) and separation of multiplet components. The curve of quadrupolar frequencies against temperature shows a discontinuity near 188°K which corresponds to a phase transition. Near it lies also the narrow doublet the interval of which should vanish near 190°K. The mean value of eQq at 173°K is found as 73.28 Mc/s. J.Jacobs

535.343

238. MICROWAVE SPECTRUM OF CYCLOPROPYL CHLORIDE. J. P. Friend, R. F. Schneider and B. P. Dailey.
J. chem. Phys., Vol. 23, No. 8, 1557 (Aug., 1955).

$J_{2\rightarrow3}$ and $J_{3\rightarrow4}$ transitions near 22 000 and 30 000 Mc/s are consistent with C–H = 1.09, C–C = 1.47, C–Cl = 1.755 A, $\angle$ H–C–H = 109°, $\angle$ HCCl = 109°, eqQ = –68.70 Mc/s for Cl^{35}. D. H. Whiffen

535.343

240. PURE QUADRUPOLE SPECTRA OF CH_3I AND CF_3I VAPORS. F.Sterzer and Y.Beers.
Phys. Rev., Vol. 100, No. 4, 1174-80 (Nov. 15, 1955).

Gives the theory of $\Delta J = 0$, $\Delta F = \pm 1$ transitions of symmetric top molecules having a nucleus with a large quadrupole moment on the axis. The manner in which the gaseous state spectrum converges on the pure quadrupole solid state spectrum as J becomes infinite is discussed. An absorption experiment is described in which six quadrupole lines of CH_3I and one of CF_3I were observed in the region between 290 and 520 Mc/s. The experiment yielded values of the quadrupole coupling constants of -1933.99 ± 0.25 Mc/s and -2142.5 ± 1.8 Mc/s respectively for CH_3I and CF_3I. These values are in agreement with previous values obtained elsewhere from rotational transitions. A.

535.347

241. DICHROIC RATIO MEASUREMENTS IN THE INFRARED REGION. E.Charney.
J. Opt. Soc. Amer., Vol. 45, No. 11, 980-3 (Nov., 1955).

An analysis of conventional optical arrangements for the measurement of dichroic ratios in the infrared region reveals that such measurements may be in error by factors up to 3 or more. These errors result from failing to account for the effects of prism polarization and of the imperfection of polarization in the transmitted beam of multiple plate AgCl polarizers. Elimination of the effect of prism polarization by a method proposed by Elliot, Ambrose and Temple is shown to be relatively ineffectual when a transmission polarizer is employed. The magnitude of the error varies with the true dichroic ratio and with the optical density of the sample for polarized radiation parallel to one of the optic axes. A frequency-dependent parameter is found to account for relatively isotropic intensity losses resulting from absorption and scattering by the AgCl in the polarizers; observed values of this parameter are given for three wavelengths, 1.67μ, 3.85μ and 4.80μ. A.

535.371

242. YELLOW LUMINESCENCE DUE TO TITANIUM IN MAGNESIUM SILICATE CONTAINING FLUORIDE. H.Dziergwa and H.Panke.
Z. Phys., Vol. 42, No. 3, 259-65 (1955). In German.

Results are given for the quantum yield, temperature dependence, absorption and afterglow of the phosphor systems $MgF_2.MgO.SiO_2$ with TiO_2 or with TiO + MnO. The duration of blue and yellow emission is increased by titanium and that of the red emission by manganese. G.F.J.Garlick

535.371

243. LUMINESCENT CENTERS IN ZnS : Cu : Cl PHOSPHORS. R.Bowers and N.T.Melamed.
Phys. Rev., Vol. 99, No. 6, 1781-7 (Sept. 15, 1955).

Measurements of the magnetic susceptibility and emission spectra have been made on zinc sulphide activated by copper and/or chlorine. The results of these measurements demonstrate that the luminescent centres are diamagnetic in the absence of optical excitation, and that of the five previously reported emissions, only three are distinct. These are: a blue emission resulting from the addition of chloride, a green emission when copper and chloride are simultaneously present, and a red emission when copper alone is present. The results are discussed on an ionic model, and on a semiconductor model. It is concluded that the blue emission is due to zinc vacancies, the green emission to substitutional copper, and the red emission to interstitial copper. A.

535.371 : 548.7

244. CRITERION FOR THE OCCURRENCE OF LUMINESCENCE. D.L.Dexter, C.C.Klick and G.A.Russell.
Phys. Rev., Vol. 100, No. 2, 603-5 (Oct. 15, 1955).

A mechanism is suggested for the nonradiative quenching

of excited states of simple impurity centres, namely a cross-over to the ground electronic state of the centre immediately after excitation and before thermal equilibrium has had time to come about. It is proposed that this mechanism is responsible for the absence of strong luminescence in some impurity and colour centres, e.g., the F-centre in alkali-halide crystals. The quenching process proposed is applicable only for certain geometries of the configuration coordinate diagram, which are discussed with a view to a criterion for strong luminescence. The quenching mechanism is consistent with known configuration coordinate curves, and leads to a prediction which is experimentally verified, to the effect that the wavelength of emitted radiation is not more than twice that of the light absorbed by the centre. The same mechanism shows the possibility of photoconductivity arising from absorption in discrete lines even at low temperatures. A.

535.372

245. FLUORESCENCE EXCITATION SPECTRA AND QUANTUM EFFICIENCIES OF ORGANIC CRYSTALS. G.T.Wright.
Proc. Phys. Soc. B, Vol. 68, Pt 10, 701-12 (Oct., 1955).

Fluorescence excitation spectra are measured for some organic crystals using excitation wavelengths down to 2200 A. The fluorescence quantum efficiency of crystalline p-terphenyl is found to be constant with wavelength of exciting radiation but apparent variations are found for trans-stilbene and particularly for anthracene crystals. These variations are due to surface escape of fluorescence the extent of which is sensitive to the depth of penetration of the exciting light in crystals which re-absorb their molecular fluorescence. The fluorescence excitation spectrum thus provides information about the absorption spectrum of the crystal. For excitation of the 001 crystal face of anthracene absorption maxima are found at 3960, 3740, 3540, 3370, 3220 A; these wavelengths are rather longer than hitherto reported. The first fluorescence maxumim lies at 3980 A hence the 0-0 absorption and fluorescence transitions effectively coincide. Measurements made with an anthracene crystal having a very thin surface quenching layer of low fluorescence efficiency show that migration of electronic excitation energy through the crystal lattice occurs initially by a short range and non-radiative process. Possible transfer mechanisms are discussed and it is concluded that the most probable process is a quantum-mechanical resonance exchange between adjacent molecules resulting in a random diffusion of the excitation energy through the lattice. This is followed by the secondary and trivial process of fluorescence emission and re-absorption. The absolute photofluorescence quantum efficiencies of p-terphenyl and trans-stilbene crystals are measured by comparison with anthracene for which the quantum efficiency is 0.80 ± 0.05. At a temperature of 290°K the efficiencies of p-terphenyl and trans-stilbene crystals are respectively 0.52 and 0.65. A.

535.375.5

246. RAMAN SPECTRUM OF O-CHLOROETHYL-BENZENE. S.L.N.G.Krishnamachari and V.Ramakrishna Rao.
Indian J. Phys., Vol. 29, No. 5, 254-5 (May, 1955).

Results are tabulated and figuratively represented. G.I.W.Llewelyn

535.375.55

247. INVESTIGATION OF THE SPECTRA OF COMBINATION SCATTERING OF LIGHT BY LIQUIDS IN THE HIGH-FREQUENCY REGION. P.D.Simova.
C.R. Acad. Bulg. Sci., Vol. 5, No. 2-3, 5-8 (April-June, Oct.-Dec., 1952). In Russian.

Frequencies exceeding 3600 cm^{-1} were found in liquids with or without hydrogen bonds. These were interpreted as overtones and combinations of normal frequencies. J.Jacobs

535.375.55

248. SIMULTANEOUS TRANSITIONS IN LIQUIDS. A NEW KIND OF MOLECULAR SPECTRUM. J.A.A.Ketelaar and F.N.Hooge.
J. chem. Phys., Vol. 23, No. 8, 1549-50 (Aug., 1955).

Binary mixtures of CS_2 with various other molecules show the Raman spectra of the latter shifted to higher wave numbers by 1515 cm^{-1} characteristic of CS_2. G.F.Lothian

535.375.56

249. THE RAMAN SPECTRUM OF ETHANE. J.Romanko, T.Feldman and H.L.Welsh.
Canad. J. Phys., Vol. 33, No. 10, 588-99 (Oct., 1955).

The rotational and rotation-vibrational Raman spectra of gaseous ethane at 1–3 atm. pressure have been photographed with a spectral resolution of approximately 1 cm^{-1}. Analyses of the rotational structures of the ν_1 and ν_3 totally symmetric bands were carried out; only the Q branch of the ν_2 band was observed. The structures of the degenerate ν_{10} and ν_{11} bands were analysed; however, no trace of ν_{12} was found. The structure of the ν_{10} band shows beyond doubt that the point group of the molecule is D_3. From the $\nu_{11} + \nu_4$ infrared band, and the ν_{11} Raman band, the value, 278.4 cm^{-1}, is deduced for the torsional frequency ν_4. A.

535.376

250. RELATION BETWEEN ORGANIC ELECTRO-LUMINESCENCE AND THE CONCENTRATION OF ACTIVE PRODUCTS. A.Bernanose and P.Vouaux.
J. Chim. phys., Vol. 52, No. 6, 509-10 (June, 1955). In French.

535.376

251. REVERSIBLE PHOSPHOR DAMAGE BY POSITIVE IONS. W.Berthold.
Naturwissenschaften, Vol. 42, No. 15, 436-7 (1955). In German.

A ZnS–Ag phosphor is given positive-ion (H_2^+) bombardment and the fall-off of luminescence efficiency measured using electron excitation. Electron excitation partially removes the effect of previous ion bombardment, the process being other than a warming of the phosphor by the electron beam. G.F.J.Garlick

535.376

252. DETERIORATION OF LUMINESCENT PHOSPHORS UNDER POSITIVE ION BOMBARDMENT. J.R.Young.
J. appl. Phys., Vol. 26, No. 11, 1302-7 (Nov., 1955).

The reduction of cathodoluminescence efficiency of phosphors has been observed after bombarding with H^+, H_2^+, He^+, Ne^+, N_2, and A^+ ions having energies from 1 to 25 keV. Detectable deterioration could be observed after a bombardment of less than 10^{-8} coulomb/mm^2 of ions (5×10^{11} ions/cm^2). The deterioration could be annealed out at temperatures between 450° and 700°C. Results indicate that light 25 keV ions probably penetrate 0.1μ to 0.2μ into the phosphor. A.

535.376

253. ELECTROLUMINESCENCE IN SINGLE CRYSTALS OF ZINC SULPHIDE. G.F.Alfrey and J.B.Taylor.
Proc. Phys. Soc. B, Vol. 68, Pt 10, 775-84 (Oct., 1955).

An apparatus for the measurement of electroluminescence in single crystals of zinc sulphide under a range of conditions is described. The results of the measurements are compared with existing theories, which are shown to be unsatisfactory. Modified forms of these theories are developed which are in much better agreement with experiment. A.

535.376

254. ELECTROLUMINESCENCE. ABSOLUTE BRIGHTNESS WAVES AND MEAN LIFETIME OF EXCITED CENTRES. G.Destriau.
J. Phys. Radium, Vol. 16, No. 10, 798-800 (Oct., 1955). In French.

535.376

255. ELECTROLUMINESCENCE OF GaP. G.A.Wolff, R.A.Hebert and J.D.Broder.
Phys. Rev., Vol. 100, No. 4, 1144-5 (Nov. 15, 1955).

Electroluminescence has been observed in single crystals. Above a threshold current the intensity of the emitted light is proportional to the a.c. and d.c. passing through the crystals. The orange colour of the light emission probably is due to the presence of Ga as activator, while the brilliant, deep red luminescence is observed in crystals where Zn is a possible activator. The temperature dependence of the luminescence is negligible in the range from liquid nitrogen temperature to 60° C. The impact excitation mechanism of Piper and Williams is proposed. A.

535.377

256. THE THERMOLUMINESCENCE OF GLASSES. T.Kikuchi.
J. Phys. Soc. Japan, Vol. 10, No. 9, 826-7 (Sept. 1, 1955).

535.377 : 537.581

257. COLORATION AND LUMINESCENCE IN CORUNDUM. A.Bohun.
Czech. J. Phys., Vol. 5, No. 3, 429-30 (Aug., 1955). In German.

The variations of thermoluminescence and thermoelectron emission with temperature are measured for X-ray coloured Al_2O_3 crystals and show correlation with each other. G.F.J.Garlick

535.39

258. PHASE CHANGE OF VISIBLE OR ULTRAVIOLET RADIATIONS ON REFLECTION AT A THIN SILVER FILM IN AIR. R.Philip.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 559-61 (Aug. 8, 1955). In French.

Malé's method (Abstr. 3272/1954) was used for film thicknesses of 72 millimicron or under, in the wavelength range 3021-5780 A. R.A.Weale

535.39

259. PHASE CHANGE OF VISIBLE OR ULTRAVIOLET RADIATIONS ON REFLECTION AT A THIN SILVER FILM--QUARTZ INTERFACE. R.Philip.
C.R. Acad. Sci. (Paris), Vol. 241, No. 7, 596-8 (Aug. 17, 1955). In French.

Measurements were made over the range 3261-5780 A for thicknesses t of 0.65-71.6 millimicron and 0.65 millimicron to 21.6 micron in the u.v. and visible respectively. There is a discontinuity in the $\triangle R'/t$ curves at long wavelengths, but none at λ = 3404 A. R.A.Weale

535.39

260. SELECTIVE REFLECTION OF CADMIUM VAPOUR. M. Spitzer.
C.R. Acad. Sci. (Paris), Vol. 241, No. 8, 631-3 (Aug. 22, 1955). In French.

Increased reflection at a silica/Cd-vapour boundary has been found for a vapour pressure of 700 mm at the resonance line 2288 A. G. F. Lothian

535.39 : 539.23

261. SPECTROPHOTOMETRIC STUDY OF THIN, TRANSPARENT FILMS AT OBLIQUE INCIDENCE. P.Bousquet.
C.R. Acad. Sci. (Paris), Vol. 241, No. 5, 478-80 (Aug. 1, 1955). In French.

The variation of the reflection by a thin film has been determined as a function of wavelength and polarization. The position of maxima and minima shows that the film does not act as a homogeneous layer of uniform refractive index. It is thought that the presence of an interface of different index on the air-film surface can explain the results. R.W.Fish

535.412

262. MULTIPLE-BEAM FRINGES OF EQUAL CHROMATIC ORDER. IV. USE OF MULTILAYER FILMS. W.F.Koehler.
J. Opt. Soc. Amer., Vol. 45, No. 11, 934-9 (Nov., 1955).

For Pt III, see Abstr. 356 (1954). The quantitative use of multilayer films in the formation of multiple-beam fringes of equal chromatic order is discussed. For this type of interference, it is necessary to use an equation of the form $n\lambda = 2t + f\lambda$ where the fraction f is a function of the wavelength. An experimental procedure is described and substantiated by theory. A.

535.412

263. MULTIPLE-BEAM FRINGES OF EQUAL CHROMATIC ORDER. V. FRINGE FINE-STRUCTURE. W.F.Koehler and W.C.White.
J. Opt. Soc. Amer., Vol. 45, No. 11, 940-4 (Nov., 1955).

A semiquantitative analysis of the formation of the fine-structures appearing on reflected fringes of equal chromatic order is reported. These fine structures are associated with irregularities on the surfaces of the interferometer plates. The analysis permits an estimation of the uncertainty in the experimentally determined height and shape of the irregularities. A.

535.417

264. REVERSE-SHEARING INTERFEROMETRY. J.W. Gates.
Nature (London), Vol. 176, 359-60 (Aug. 20, 1955).

A simplified form of reverse-shearing interferometer is described. This makes use of the square prism so frequently used in photometry and in the Kösters interferometer. Two alternative beam-splitting arrangements are described. The advantages and disadvantages of the system are discussed briefly. S. Tolansky

535.417

265. INTEGRATED FLUX FROM A MICHELSON OR CORNER-CUBE INTERFEROMETER. E.R.Peck.
J. Opt. Soc. Amer., Vol. 45, No. 11, 931-4 (Nov., 1955).

Flux in the circular fringe pattern of a Michelson or corner-cube interferometer is integrated over a centred, circular or rectangular field stop, as is done experimentally by a photoelectric cell in fringe counting. The results are discussed in terms of fringe amplitude, modulation depth, and phase shift. A.

535.42

266. IMAGES OF INCOHERENTLY ILLUMINATED BRIGHT AND OPAQUE DISKS. W.Weinstein.
J. Opt. Soc. Amer., Vol. 45, No. 12, 1006-8 (Dec., 1955).

Formulae are obtained for the images of incoherently illuminated bright and opaque disks under the assumptions of scalar diffraction theory. Results are given in graphical form for disks with diameters of the same order of magnitude as the Airy disk and applied to problems of flying spot microscopy. A.

535.42 : 534.39

267. THE DIFFRACTION OF PARALLEL BEAMS OF LIGHT BY TRAVELLING ULTRASONIC WAVES. I. E.H.Wagner.
Z. Phys., Vol. 141, No. 5, 604-21 (1955). In German.

The diffraction is treated as a boundary value problem in Maxwellian theory. The modulation of the refractive index of the fluid by the ultrasonic waves and the multiple reflections give rise to an infinite number of waves with frequency $\omega_0 + \nu\omega'$ (ω' = ultrasonic frequency, ν = 0, $\pm$1, $\pm$2 etc.). The solution of the diffraction problem is then the super position of these multiple fields, and may be found by solving the usual 2nd order differential equations. R.W.Fish

535.42 : 534.39

268. THE DIFFRACTION OF PARALLEL BEAMS OF LIGHT BY TRAVELLING ULTRASONIC WAVES. II. E.H.Wagner.
Z. Phys., Vol. 141, No. 5, 622-42 (1955). In German.

The treatment of Pt I is considered in further detail, and the type of diffraction obtained for a variety of system parameters is discussed. Typical calculations are compared with experimental results and with the results of other workers. R.W.Fish

535.43

269. ELEVEN ADDITIONAL LIGHT SCATTERING FUNCTIONS FOR SPHERICAL PARTICLES OF REFRACTIVE INDEX OF 2. M.Kerker and A.L.Cox.
J. Opt. Soc. Amer., Vol. 45, No. 12, 1080 (Dec., 1955).

Light scattering functions, A_n and P_n, have been calculated for eleven values of $\alpha = 2\pi r/\lambda$ from $\alpha = 3.3$ to $\alpha = 12.5$ for spherical particles of refractive index, $m = 2$. Intensity functions have been calculated for angle of observation, $\gamma = 130^0$, for 23 values of α from $\alpha = 1.3$ to $\alpha = 12.5$. A.

535.43

270. SCATTERING FUNCTIONS FOR SPHERICAL PARTICLES OF REFRACTIVE INDEX OF 1.46–4.30i. M.Kerker.
J. Opt. Soc. Amer., Vol. 45, No. 12, 1081 (Dec., 1955).

Mie scattering functions for spherical particles of index of refraction 1.46 to 4.30i for 23 values of α from 0.4 to 5.0 are presented. A.

535.43 : 535.36

271. ON THE DIFFUSION OF RADIATION FROM A POINT OR A LINE SOURCE IN AN INFINITE MEDIUM. J.T.Jefferies.
Optica Acta, Vol. 2, No. 3, 109-11 (Oct., 1955).

The approximate equation of transfer for diffused radiation in a scattering medium is obtained and applied to the cases of infinite media illuminated by a point source or by an infinite line source of radiation. A.

535.43 : 551.521.3

272. THE DIFFUSION OF LIGHT THROUGH A SCATTERING LAYER OF GREAT OPTICAL THICKNESS. S. Piotrowski.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 3, No. 6, 303-6 (1955).

Chandrasekhar's method, involving the equation of radiative transfer, is used to solve the geophysical problem of light diffusion by a plane-parallel scattering layer of great optical thickness. The results are applied to the case of terrestrial clouds of water-drops; and explain why, in spite of its very high surface brightness, the sun is invisible through cloud transmitting as much as 20% of the incident sunlight. D. R. Barber

535.435

273. LIGHT SCATTERING BY WATER. J. Kraut and W. B. Dandliker.
J. chem. Phys., Vol. 23, No. 8, 1544-5 (Aug., 1955).

The intensity/angle curve shows a small effect explained by anisotropy; value of $R_u(90)$ are determined for 4 wavelengths. G. F. Lothian

535.435

274. MOLECULAR THEORY OF LIGHT SCATTERING. M.Fixman.
J. chem. Phys., Vol. 23, No. 11, 2074-9 (Nov., 1955).

The Einstein–Smoluchowski phenomenological theory of light scattering is shown to agree with the molecular theory of light scattering for a one-component system of isotropic scattering molecules. A.

535.435 : 532.7

APPLICATION OF THE DEGREE OF DEPOLARIZATION OF SCATTERED LIGHT TO THE STUDY OF INTERACTIONS IN A FLUID. See Abstr. 118.

535.542.1

275. A LARGE-FIELD BIREFRINGENT COMPENSATOR. M.Françon and B.Sergent.
Optica Acta, Vol. 2, No. 3, 151-2 (Oct., 1955). In French.

The use of a Babinet compensator is limited in convergent light by the presence of hyperbolic isochromatic lines. Three double-prism systems are described which have 26 times the field and therefore can be used in quite strongly convergent light. Typical applications in microscopy are described. R.W.Fish

535.568.1 : 545.8

276. HIGH TEMPERATURE RECORDING POLARIMETER. R.S.Saltzman, J.F.Arbogast and R.H.Osborn.
Analyt. Chem., Vol. 27, No. 9, 1446-8 (Sept., 1955).

A polarimeter has been developed to meet the need for a means of continuously monitoring the optical rotation of a plant stream of molten resin at 180° C. The instrument contains an arrangement of two photovoltaic cells in a balanced electrical network. A change in the optical rotation of the sample stream creates an unbalance signal in the network which, after amplification, actuates the balance motor of a recorder. This motor simultaneously moves the recorder pen and rotates a polarizer in the instrument until balance is restored. The polarimeter is rugged and stable, and has an over-all accuracy within about 1%. A.

535.65

277. APPLICATION OF THE BINOCULAR MATCHING METHOD TO THE STUDY OF THE SUBJECTIVE APPEARANCE OF SURFACE COLOURS. E.G.T.Wassef.
Optica Acta, Vol. 2, No. 3, 144-50 (Oct., 1955).

The assumptions underlying the technique are considered. A factorial experiment was designed to examine the relative importance of the influences of changing the illuminant and the background on the hue of some red, green and purple samples of different levels of value and chroma, and to assess the interactions of these factors. Statistical analysis of the data showed that the standard error of a single match was about two hue steps; and that it was possible, without repeating any matches, to evaluate the influences of these factors within close tolerances. A.

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

535.81

278. FILMED SURFACES FOR REFLECTING OPTICS. G.Hass.
J. Opt. Soc. Amer., Vol. 45, No. 11, 945-52 (Nov., 1955).

A survey of films and film combinations. The preparation and properties of unprotected mirror coatings, protective layers for front surface mirrors, reflection filters, and replica mirrors are discussed. A.

535.81

279. AUTOMATIC DESIGN OF TELESCOPE DOUBLETS. R.E.Hopkins and T.Lauroesch.
J. Opt. Soc. Amer., Vol. 45, No. 11, 992-4 (Nov., 1955).

An I.B.M. Card Program Computer has been programmed to compute thin-lens aplanatic doublets. Thirty-eight solutions are included in a table. One solution is completely ray-traced after proper thicknesses are added to show the value of a thin lens solution. A.

535.824.3

280. DOUBLE-ILLUMINATION MICROSCOPY. M.A.MacConaill.
Nature (London), Vol. 176, 877 (Nov. 5, 1955).

Parts of an unstained preparation may appear black if they reflect light. Such parts may be distinguished if the

specimen is illuminated by green transmitted light from a substage condenser and red reflected light from a lamp house and condenser from above. R.W.Fish

HEAT 536

536.2.01 : 538.114

281. ON THE THERMAL CONDUCTIVITY OF FERROMAGNETICS. H.Sato.
Progr. theor. Phys., Vol. 13, No. 1, 119-20 (Jan., 1955).

Discusses the contribution of spin-wave scattering to thermal conductivity. The mean free path is estimated to be cm at about 10^0K, so that boundary scattering predominates below this temperature, and the conductivity is proportional to T^{-1} in this range. E.P.Wohlfarth

536.2.01 : 548.7

282. HEAT CONDUCTION IN ELECTRICALLY INSULATING CRYSTALS. G.Leibfried and E.Schlömann.
Nachr. Akad. Wiss. Göttingen, math.-phys. Kl. IIa, No. 4, 71-93 (1954). In German.

The authors consider scattering of lattice waves arising from the anharmonic terms in the potential energy, and calculate the thermal conductivity κ approximately by converting the Boltzmann equation for the lattice distribution function into an equivalent variational problem. The detailed calculations are based on the model of a face-centred cubic lattice with central nearest-neighbour forces. κ is found to be proportional to $(T/\theta)^3 \exp[\sqrt{(3/5)}\,\theta/T]$ at low temperatures. The theory is compared with recent experimental results on Al_2O_3, diamond and solid He. E.H.Sondheimer

536.212

283. THE DISTRIBUTION OF HEAT IN A ROD CONSISTING OF TWO SIMILAR PARTS OF VARIABLE LENGTH, BOUNDARY CONDITIONS BEING LINEAR. I.Zlatev.
C.R. Acad. Bulg. Sci., Vol. 4, No. 1, 5-8 (Jan.-March, 1951). In Russian.

Conditions determining the progress of thermal conduction are, as usual, expressed in terms of linear relations involving the temperature and heat flow at two points. These points, however, are assumed to change their positions in the course of time. Appropriate solutions of the equation of thermal conduction are obtained in the form of superposed point sources, involving a pair of unknown functions which can be derived by solving two simultaneous linear integral equations.
R.Eisenschitz

536.252

284. FREE CONVECTION BETWEEN TWO VERTICAL PLATES IN THE PRESENCE OF AN INCLINED TEMPERATURE GRADIENT. S.Prager.
J. chem. Phys., Vol. 23, No. 9, 1742 (Sept., 1955).

The customary way of realizing a temperature gradient in a liquid without associated convection currents is to have a vertical column with a temperature gradient directed upwards. Small deviations of the gradient from the vertical give rise to steady convection. A mathematical investigation of the velocity distribution for parallel plates, and any inclination of the gradient, is given. F.E.Hoare

536.461

285. EFFECT OF TURBULENCE ON FREE FLAME GROWTH. W.R.Mickelsen and N.E.Ernstein.
J. chem. Phys., Vol. 23, No. 8, 1558 (Aug., 1955).

Growth rates of spark-ignited free flame globules in a flowing turbulent gas mixture have been measured photographically and by ionization gaps, over times not quite equal to the characteristic diffusion time of turbulence as defined by Taylor, and have been found to vary statistically. For all conditions studied, the lower portions of the distribution curves fall below the laminar flame speed value. The results are interpreted as showing a diffusive effect of turbulence which lowered the flame temperature and thus the flame speed.
R.C.Murray

536.48

286. SOME COMMENTS ON THE SPECIFIC HEAT OF LIQUID He^3. Z. Mikura.
Progr. theor. Phys., Vol. 13, No. 1, 120-2 (Jan., 1955).

In calculating the Debye specific heat of longitudinal waves the author derives the velocity of sound by an empirical formula from the critical data, the density and the molecular weight of He^3. The difference between the experimental and calculated specific heat is found to be constant between 0.5 and 1.8°K. R.Eisenschitz

536.48

287. λ TRANSITION IN LIQUID HELIUM. G.V.Chester.
Phys. Rev., Vol. 100, No. 2, 455-62 (Oct. 15, 1955).

It is shown, by means of an expansion formula, that Feynman's partition function for liquid helium exhibits a second-order lambda transition. The validity of the expansion is discussed and it is shown that it is very likely to be valid for the case under consideration. A discussion is also given of some general properties of Feynman's partition function.
A.

536.48 : 530.162

288. STATISTICAL MECHANICS OF LIQUID He^3. R.Kikuchi.
Phys. Rev., Vol. 99 No. 6, 1684-91 (Sept. 15, 1955).

The partition function which Feynman has proposed for liquid He^4 is extended to the case of liquid He^3, taking into account the Fermi–Dirac statistics and the nuclear spin of $\frac{1}{2}$. The nuclear magnetic susceptibility is calculated and compared with the observation of Fairbank, Ard and Walters. Theoretical and experimental curves fit when the effective mass of the He^3 atom is taken about four times its true mass. The entropy of the system has not been calculated. A.

536.48 : 532.7

289. ATOMIC DISTRIBUTION IN LIQUID HELIUM BY NEUTRON DIFFRACTION. D.G.Hurst and D.G.Henshaw.
Phys. Rev., Vol. 100, No. 4, 994-1002 (Nov. 15, 1955).

The angular distribution of 1.04 A neutrons scattered by liquid helium has been measured for a series of temperatures between 1.6°K and 5.04°K over the angular range 3° to 70°. The scattering patterns are characterized by one principal maximum at an angle of 19.6 ± 0.5^0 over a large range in liquid density. No marked change in the scattering pattern accompanies the lambda-transition. It is shown that for large-angle scattering the liquid behaves like a system of free helium atoms. Scattering intensities normalized to the differential cross-section for a free helium atom have been transformed to give the radial distribution functions at 5.04°K, 4.24°K and in the region of 2°K. The first maximum in the density is at 3.5_0 A for the lowest temperature and at 3.6_8 A for the highest. The density change is not accounted for by the shift of the maximum, and a decrease in the number of neighbours is postulated. The mean radial positions assigned to the first and second neighbours using the analysis of this paper agrees with a close-packed configuration of symmetrical particles, but the average number of the first neighbours appears to be less than a complete close-packed arrangement, in keeping with the random arrangement expected for a liquid. A.

536.48 : 532.7

290. MOTION OF NUCLEI IN LIQUID HELIUM. W.V.Houston and H.E.Rorschach.
Phys. Rev., Vol. 100, No. 4, 1003-7 (Nov. 15, 1955).

It is suggested that nuclear motions in a solid or a liquid

at very low temperatures should be treated along the lines usually used for electrons, and the method is applied to liquid helium. Treating the nuclei as independent particles gives indications of the observed behaviour of both the specific heat and the paramagnetic susceptibility of He^3. Further consideration of the internuclear interactions brings the results closer to the observed values. Application to He^4 gives also a qualitative understanding of the observed phenomena. A.

536.48 : 532.73

291. ON THE SPECIFIC HEAT OF A SOLUTION OF He^3 IN LIQUID He^4. Z.Mikura.
Progr. theor. Phys., Vol. 13, No. 1, 122-3 (Jan., 1955).

Experimental values of the specific heat of a 2.5% solution at temperatures between 1 and 2.1°K are compared with the results of calculated specific heat curves as derived from various models. The author claims that this test verifies the assumption of He^3 behaving as an ideal gas in solution. R.Eisenschitz

536.48 : 536.423.15

292. LIQUID HELIUM VAPOR PRESSURE EQUATION. J.R.Clement, J.K.Logan and J.Gaffney.
Phys. Rev., Vol. 100, No. 2, 743-4 (Oct. 15, 1955).

An empirical equation has been developed which is valid throughout the entire range of temperatures below the critical point, and is in accord with the latest available data on the vapour pressure to within about ± 0.002°K. A.

536.48

293. HELIUM FILM TRANSFER RATE FROM 0.14 to 2.19°K. R. K. Waring, Jr.
Phys. Rev., Vol. 99, No. 6, 1704-7 (Sept. 15, 1955).

The transfer rate of the mobile helium film, over Pyrex glass, was measured as a function of temperature in the range from 0.14°K to the lambda point. The bulk of the observations was concerned with film transport due to a thermal gradient but a measurement, using the same apparatus, was made at 1.1°K under a gravitational potential as a comparison. At this temperature it was found that the transport rates, in the two cases, differ by a factor of nearly two, and below 1°K the rate was found to increase with decreasing temperature by about 10%. A.

536.48

294. SUB-CRITICAL FLOW IN THE HELIUM II FILM. B. S. Chandrasekhar and K. Mendelssohn.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 857-73 (Oct., 1955).

While in most observations on the helium II film, transport at the critical velocity has been studied, the present paper describes observations of film transfer at velocities less than the critical. Three different methods of investigation have been employed. The first is an analogue of an electrical circuit embodying a current-potential measurement on a superconductor. The second method uses as indicator the formation of bulk liquid out of a film which passes over a surface of varying perimeter. In these two methods film transfer occurs from a higher to a lower meniscus of bulk liquid. In the third method film transfer is initiated by the introduction of a thermal gradient and transfer rates under varying heat input are studied. The experiments show conclusively that, similar to the phenomenon of superconductivity below a critical velocity, flow of helium through the film is completely free of dissipation. The third method has been used to determine the heat of transport for the film, and these experiments are described and discussed in an Appendix. A.

536.48 : 536.75

295. THE ENTROPY OF SUPERFLUID HELIUM. D.F.Brewer, D.O.Edwards and K.Mendelssohn.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 939-40 (Oct., 1955).

Determination of the heat of transport $Q = T\Delta S$ between 1.14°K and 2.05°K with an accuracy better than 2%. ΔS agrees within 5% with the total entropy measured by Kramers, Wasscher and Gorter (Abstr. 7227/1952). Since at 1.2° S(ph)/S(tot) is about 0.25, where S(ph) is the phonon contribution, it follows that the phonons do not participate in the superfluid transport. H.London

536.48

296. SECOND SOUND ATTENUATION IN ROTATING HELIUM II. R. G. Wheeler, C. H. Blakewood and C. T. Lane.
Phys. Rev., Vol. 99, No. 6, 1667-72 (Sept. 15, 1955).

An experiment is described wherein liquid helium II is rotated in an annulus between a metal cylinder which rotates at constant speed and a concentric cylindrical cavity at rest. Second-sound pulses, propagated parallel to the cylindrical axis and through a substantially uniform velocity field, are found to suffer an extra attenuation due to the motion of the fluid. If σ is defined as the ratio of the received thermal pulse heights (fluid in motion v. fluid at rest), then for angular velocities of the cylinder ω and second-sound path lengths l it appears that $\sigma = e^{-\beta\omega l}$. The coefficient β decreases somewhat with rising temperature in the range from about 1.2 to 2.0°K, having a value of $(8 \pm 0.8) \times 10^{-3}$ rev^{-1}. cm^{-1}. sec at 1.39°K. The effect is discussed in the light of present knowledge concerning the nature of helium II. A.

536.483

297. METHOD FOR MAINTAINING LEVEL OF LIQUEFIED GAS REFRIGERANTS. R.D.Goodwin.
Rev. sci. Instrum., Vol. 26, No. 11, 1052-3 (Nov., 1955).

Controls are described for maintaining a constant level of liquid nitrogen in a still-head can. A small electric solenoid valve is employed directly in the liquid nitrogen line, operating under the control of a sensitive level switch. The method and associated instruments are described, including a rapid means for changing supply cans. A.

536.531

298. AN EQUIVALENT CIRCUIT OF A BOLOMETER. Y.Urano.
J. Phys. Soc. Japan, Vol. 10, No. 10, 864-8 (Oct., 1955).

Regarding a bolometer as an active four-terminal network which connects the heat-flow circuit to the electrical circuit, the equivalent circuit of a bolometer is obtained, and by means of this the physical meaning of the dynamic impedance of a bolometer is made clear. The stability of a bolometer circuit is also considered. A.

536.62 : 541.115

299. DIFFERENTIAL MICROCALORIMETER. STUDY OF STABILITY. R.Charuel and P.Traynard.
J. Chim. phys., Vol. 52, No. 6, 441-6 (June, 1955). In French.

Describes a device for measuring the rate of heat evolution during the hydration of cellulose materials. Two Dewar vessels are used, one containing the specimen and the other a resistance in which a compensating Joule heat is produced. A theoretical and experimental study of stability is made. The sensitivity is 10^{-3} cal. sec.$^{-1}$. L.G.Carpenter

536.631

300. ON THE SPECIFIC HEAT OF NORMAL SOLID ALCOHOL OF PROBABLE CARBON NUMBER 32. R.Shishikura.
J. Phys. Soc. Japan, Vol. 10, No. 10, 903 (Oct., 1955).

A preliminary specific heat measurement has been carried out within the range 35–105°C. The sample melts at 86.4°C, and the specific heat shows a sharp peak at 73°C. The author believes the data to be the first which indicate the existence of a rotational transition in a long alcohol chain with carbon number higher than 30. The heats of transition and fusion are 11.5 cal/g and 40.3 cal/g respectively. E.W.Kellermann

536.631 : 536.7 : 538.221

01. HEAT CAPACITY OF ZINC FLUORIDE FROM 11 TO 00°K. THERMODYNAMIC FUNCTIONS OF ZINC FLUORIDE. NTROPY AND HEAT CAPACITY ASSOCIATED WITH THE NTIFERROMAGNETIC ORDERING OF MANGANOUS FLUO-IDE, FERROUS FLUORIDE, COBALTOUS FLUORIDE, AND ICKELOUS FLUORIDE. J.W.Stout and E.Catalano. . chem. Phys., Vol. 23, No. 11, 2013-22 (Nov., 1955).

The heat of ZnF_2 has been measured calorimetrically between 11 and 300°K. In addition to the direct experimental ata, values of heat capacity, entropy, enthalpy and free energy are tabulated at selected temperatures. The values of ntropy and enthalpy at 298.16°K are $S^0 = 17.61 \pm 0.03$ cal.deg^{-1} ole^{-1} and $H^0 - H_0^0 = 2827 \pm 5$ cal.mole^{-1}. The heat capacity of nF_2 has been used, with a corresponding states argument, to stimate the lattice contributions to the entropy and heat capacity of the isomorphous fluorides MnF_2, FeF_2, CoF_2 and NiF_2 hich exhibit heat capacity maxima associated with antiferromagnetic ordering at 66.5, 78.35, 37.70 and 73.22°K, respectively. The values of electronic entropy at the maximum in heat apacity are: MnF_2, 0.85R ln6; FeF_2, 0.87R ln5; CoF_2, .80R ln2; NiF_2, 0.71R ln3. The electronic entropies and heat apacities are compared with molecular-field and spin-wave neories of antiferromagnetism. At very low temperatures he electronic heat capacity on NiF_2 is varying approximately s $T^{3/2}$ whereas that of the other antiferromagnetic fluorides epends much more strongly on temperature. This behaviour f the electronic heat capacity of NiF_2 is believed to be assoiated with the small ferromagnetic moment found in magnetic nisotropy measurements on this salt. A.

THERMODYNAMICS 536.7/.8

536.71

302. ADIABATIC COMPRESSION OF AN IDEAL GAS NDER FINITE PISTON-VELOCITIES. R.Schlögl. Z. Phys., Vol. 141, No. 5, 585-91 (1955). In German.

The Hugoniot equations $(P_1V_1 - P_0V_0)/(\kappa - 1) = (P_1 + P_0) \times (V_0 - V_1)/2$; $w^2 = (P_1 - P_0)(V_0 - V_1)$; $D_1^2 = V_0^2(P_1 - P_0)/(V_0 - V_1)$ when the subscripts 0 and 1 refer to the pressure and volume of the gas respectively before and after compression, w denotes the velocity of the piston, and D_1 the velocity of the mpact wave due to the motion of the piston) are used to derive n expression for the equation of state of an ideal gas contained in a cylinder in which the piston moves with a constant inite velocity. For the limiting case of a small piston-velocity the relation assumes a particularly simple form. The equation is not applicable to the case of expansion. J.S.G.Thomas

536.75 : 541.183.5

303. THERMODYNAMIC PROPERTIES OF KRYPTON ADSORBED ON TITANIUM DIOXIDE (RUTILE). E.L.Pace, K.S.Dennis and W.T.Berg. J. chem. Phys., Vol. 23, No. 11, 2166-8 (Nov., 1955).

The zero point entropy of krypton adsorbed on titanium dioxide (rutile) has been determined at a coverage of 0.57 of the monolayer capacity from calorimetric measurements of the heat capacity, differential heat of adsorption, and from adsorption isotherms. The value is 0.4 cal.deg^{-1}mole^{-1} with an experimental uncertainty of the order of $\pm$ 0.8 cal deg^{-1}mole^{-1}. Within this high uncertainty, the result is in essential agreement with the results of Morrison and co-workers for argon adsorbed on rutile and Aston and co-workers with neon adsorbed on rutile. A.

ELECTRICITY 537

537.122 : 530.145

304. EFFECT OF RADIATION ON THE SELF-ENERGY OF AN ELECTRON. D.S.Kothari and F.C.Auluck. Progr. theor. Phys., Vol. 13, No. 1, 100-1 (Jan., 1955).

It is noted that an expression previously obtained (Abstr. 3579/1948) for that part of the self-energy due to the radiation field is valid for strong fields and should admit a classical derivation. Such a derivation is given. R.A.Newing

ELECTROSTATICS. DIELECTRICS 537.2

537.212 : 537.543

305. AN ELECTRONIC METHOD OF MEASURING THE STRENGTH OF AN ELECTROSTATIC FIELD. A. Aizenshtein. C. R. Acad. Bulg. Sci., Vol. 4, No. 2-3, 25-8 (April-June, Oct.-Dec., 1951). In Russian.

An externally applied electrostatic field can be used instead of a grid electrode to control the anode current of a valve. When the external field is applied the anode current changes, but owing to the finite conductivity of the glass envelope returns to its former value in from 1 sec to 12 min. Quartz glass is found to be the most satisfactory material for the envelope, and a Philips electrometer valve 4060 was employed. Used with a d.c. amplifier the earth's electrostatic field can be measured. A. L. Mackay

537.213

306. AUTOMATIC ELECTROMETER SCALER. P.Luger. Rev. sci. Instrum., Vol. 26, No. 10, 948-51 (Oct., 1955).

An automatic arrangement is described for operating an electrometer. Double parallel optical slits replace the ordinary eyepiece-reticule scale, or the scale of a mirror-scale arrangement. Photoelectric signals are produced when the real image of the electrometer needle or the light beam crosses the optical slits. These signals operate the electrometer itself and a time-interval printer. Both current and sensitivity measurements are left on a printed record. Continuous or intermittent-continuous operation make the apparatus completely automatic. A.

537.214

307. A TWO-DIMENSIONAL ELECTROSTATIC PROBLEM. I. E.G.Nadjakoff. C.R. Acad. Bulg. Sci., Vol. 6, No. 2, 1-4 (April-June, 1953). In German.

A preliminary account of the calculation of the coefficients of capacity of a two-dimensional, three-conductor system based on the application of the method of conformal representation. C.G.Morgan

537.214

308. A TWO-DIMENSIONAL ELECTROSTATIC PROBLEM. II. E.G.Nadjakoff. C.R. Acad. Bulg. Sci., Vol. 6, No. 2, 5-8 (April-June, 1953). In German.

The results of Pt I are extended so that they can be applied to the practical case of a quadrant electrometer. C.G.Morgan

537.214

309. ON THE EDGE EFFECT IN A QUADRANT ELECTROMETER. E.G.Nadjakoff. C.R. Acad. Bulg. Sci., Vol. 6, No. 2, 9-12 (April-June, 1953). In German.

The results of papers reported in the two preceding abstracts are used to calculate edge effects in a quadrant electrometer, and these are composed with experimental data. C.G.Morgan

537.226.2

310. DIELECTRIC PROPERTIES OF LIQUID BUTYL ALCOHOLS. W.Dannhauser and R.H.Cole.
J. chem. Phys., Vol. 23, No. 10, 1762-6 (Oct., 1955).

Measurements of static dielectric constant were made for all except t-butyl alcohol from the boiling points to −140° C; dispersion and loss were measured below 0° C in the range 20 c/s to 2 Mc/s. Multiple dispersion were found as in other alcohols. The temperature dependences of static values are examined in terms of finite extent of chainwise molecular coordination by hydrogen bonding, and the rate laws of the dispersions are discussed. A.

537.226.2

311. DIELECTRIC PROPERTIES OF METHANOL AND METHANOL-1-PROPANOL SOLUTIONS. D.J.Denney and R.H.Cole.
J. chem. Phys., Vol. 23, No. 10, 1767-72 (Oct., 1955).

Measurements of dispersion in the solutions show that at all concentrations the principal dispersion is a simple relaxation process, while the higher-frequency behaviour gives evidence of overlapping dispersions. As in other alcohols, the temperature dependences of relaxation times differ markedly from simple rate laws, especially for temperatures below 200° K. The significance of the results in relation to reorientation of hydroxyl and alkyl groups and intermolecular hydrogen bonds is discussed. Difficulties in measurements on solid methanol are described and their possible origins examined. A.

537.226.2

312. DIELECTRIC CONSTANT OF QUARTZ AS A FUNCTION OF FREQUENCY AND TEMPERATURE. M.R.Stuart.
J. appl. Phys., Vol. 26, No. 12, 1399-404 (Dec., 1955).

Measurements of dielectric constant and power loss were made from 1 to 90 kc/s and from 20 to 400° C. The dielectric constant parallel to the optic axis for all frequencies shows a sharp rise, which occurs at successively higher temperatures for higher frequencies. The loss at a given frequency has a temperature maximum which is higher, the higher the frequency. The results are partially explained by assuming that ions are present in "tunnels" parallel to the optic axis. The density and mobility of these ions are obtained. The density is temperature dependent in such a way as to lead to an activation energy of 17.7 kcal per mole. Lithium ions were introduced into the crystals, and the effects caused by these ions were at least compatible with the assumption that lithium ions were originally present. Perpendicular to the optic axis none of the above effects exist. A.

537.226.8

313. DIELECTRIC STRENGTH OF ORGANIC LIQUIDS. H.House.
Nature (London), Vol. 176, 610-11 (Sept., 1955).

By eliminating pulses at high field strengths the conductivity of hexane could be measured at stresses up to 1500 and 1150 kV/cm for gaps of 25 and 150 microns respectively. There were no polarity effects with symmetrical electrodes, but the conductivity depended on the material of the cathode when electrodes of different metals were used. P.Cucka

537.226.8

314. ANOMALOUS DIELECTRIC DISPERSION IN POLAR MACROMOLECULAR SOLUTIONS. W.G.Hammerle and J.G.Kirkwood.
J. chem. Phys., Vol. 23, No. 10, 1743-9 (Oct., 1955).

The Kirkwood and Fuoss theory of dielectric dispersion in polymer solutions is recalculated by including the Oseen hydrodynamic interactions in the polymer's diffusion tensor. The theoretical results agree with experiment where comparison is possible. The recalculation gives root-mean-square molecular dimensions consistent with values calculated from viscosity and light scattering. A.

537.228.1 : 534.232

315. ON THE METHODS OF INVESTIGATIONS OF PIEZO CRYSTALS USED AS ULTRASONIC TRANSDUCERS. B. Özdoğan.
Rev. Fac. Sci. Univ. Istanbul C, Vol. 20, No. 1, 14-34 (Jan., 1955).

This work is a discussion of the several methods used for the selection of piezo-crystals which produce a uniform sound field. For crystals vibrating slower than 1.5 Mc/s, the best method is to investigate the frequency spectrum and the quality factors of each frequency. In order to obtain additional information concerning the mode of vibration, the acoustical interferometer is used. A high-frequency capacity bridge has been found very convenient for the investigation of the frequency spectrum, and the measurement of the Q-factors is performed with a standard oscillator using the beat method. Some results are given for different types of crystals, rectangular, circular, and Straubel. The Q-factors of a crystal are also measured in an interferometer. A comparison is made between the calculated values of proper frequencies of rectangular quartz crystals using the formula given by Bechmann and the experimental values. The Q-values have been measured for the frequencies. As a result, the Q-factors of thickness vibrations are found to be about 10 times higher than the others. The results have been discussed from the point of view of the sound field and some Schlieren photographs have been taken. A.

537.228.4

316. THE DYNAMIC ELECTRICAL BIREFRINGENCE OF RIGID MACROMOLECULES. I.Tinoco, Jr.
J. Amer. Chem. Soc., Vol. 77, No. 17, 4486-90 (Sept. 5, 1955).

Benoit's theory (Abstr. 281/1952) of the dynamic electrical birefringence of rigid molecules under the action of a rectangular electrical pulse has been extended to include the effect of a transverse component of the permanent dipole moment, and the effective orienting field acting on the permanent dipole has been explicitly considered. The proton polarizability contribution to the induced dipole moment introduced by Kirkwood and Shumaker has also been considered. A new interpretation of Benoit's electrical birefringence measurements on nucleic acid has been made. A.

537.228.4

317. THEORETICAL STUDIES OF THE KERR EFFECT. I. DEVIATIONS FROM A LINEAR POLARIZATION LAW. A. D. Buckingham and J. A. Pople.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 905-9 (Oct., 1955).

A theoretical expression is derived for the Kerr constant of a gas at low pressures using a general expression for the energy of a molecule in a strong electric field. It is shown that the temperature-independent part is closely related to the change of molecular polarizability with field strength. For spherically symmetric systems, the measured Kerr constant can be used to find the magnitude of this hyperpolarizability. A.

537.228.4

318. THEORETICAL STUDIES OF THE KERR EFFECT. II. THE INFLUENCE OF PRESSURE. A. D. Buckingham.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 910-19 (Oct., 1955)

A statistical-mechanical theory of the Kerr constant is presented, and expressions are derived which are applicable at any density. For anisotropic molecules without permanent dipole moments, the Kerr constant is expanded in powers of the polarizability and the leading non-vanishing terms retained. To this order of accuracy, the molecular Kerr constant of molecules of this type is unaffected by pressure changes provided the forces acting between the molecules are independent of orientation. Experimental data for some compressed non-polar gases support this conclusion. For orientationally de-

)endent intermolecular forces, the Kerr constant is expanded n powers of the density and the leading term representing a leparture from ideal behaviour is discussed in some detail or both polar and non-polar molecules. A.

ELECTRIC CONDUCTION. CURRENTS 537.3

537.311 : 537.529

319. PREBREAKDOWN CURRENT AND NOISE IN INSULATORS. D.A.Powers and T.Suita.
J. appl. Phys., Vol. 26, No. 10, 1244-8 (Oct., 1955).

The frequency spectrum of the noise associated with prebreakdown currents in insulators has been investigated in the audio-frequency range. Most of the noise is due to surface discharges which can be eliminated by special types of electrodes and careful experimentation. The remaining noise has a frequency spectrum with the highest amplitudes at very low frequencies; it falls rapidly to the Johnson noise level in the measuring resistor at about 10^4 c/s. This noise apparently originates from fluctuations in the field-emission current. A.

537.311.3

320. AN EXPERIMENT IN ELECTRICAL MEASUREMENTS WHICH TEACHES SEVERAL VALUABLE LESSONS. F.T.Worrell.
Amer. J. Phys., Vol. 23, No. 8, 499-502 (Nov., 1955).

An experiment is described wherein the resistance of a galvanometer is measured by several different methods. A number of difficulties arise in this experiment, which are analysed. It is shown how these difficulties can be used to give the student important lessons about good experimentation. A.

537.311.31

321. EFFECT OF POINT IMPERFECTIONS ON THE ELECTRICAL PROPERTIES OF COPPER. I. CONDUCTIVITY. F.J.Blatt.
Phys. Rev., Vol. 99, No. 6, 1708-16 (Sept. 15, 1955).

Changes in resistivity due to the addition of substitutional impurities and due to the presence of vacancies or interstitials in copper have been evaluated. It was assumed that the free-electron approximation is valid and that Matthiessen's rule holds. Relaxation of the lattice about the imperfections was neglected. The scattering potentials for the various imperfections were derived from the appropriate Hartree fields, and the partial wave method was employed in the evaluation of the scattering cross-sections. In each case, the potentials were adjusted until the phase shifts satisfied the Friedel sum rule. The phase-shift calculations were carried out on the ILLIAC (electronic digital computer). The calculated resistivities due to small concentrations of gallium, germanium, and arsenic in copper, though consistently too large, are in fair agreement with measurements of Linde. The calculated change in resistivity due to interstitials in copper, 1.4 microhm.cm per atomic percent, is essentially the same as that due to an equal concentration of vacancies. This result is at variance with earlier predictions based on annealing experiments on irradiated copper. A recent interpretation of the annealing spectrum of irradiated copper by Cooper, Koehler, and Marx appears to be consistent with the present results and offers agreement with a variety of theoretical and experimental work, although some difficulties remain unresolved. On the basis of the calculations reported here and comparison with Linde's results for dilute substitutional alloys of copper, it is concluded that the resistivity increase due to a concentration of one atomic percent of Frenkel defects in copper is probably between 1.5 and 2.0 microhm.cm, with vacancies and interstitials contributing about equally to the scattering of conduction electrons. A.

537.311.33

322. GRAPHICAL TREATMENT OF DEGENERACY OF AN INTRINSIC SEMICONDUCTOR. G.Busch.
Helv. phys. Acta, Vol. 28, No. 4, 320-1 (1955). In German.

A simple demonstration of the conditions under which deviations from Maxwellian statistics are expected for electrons and holes. C.A.Hogarth

537.311.33

323. CARRIER DIFFUSION BY IONIZED IMPURITIES IN SEMICONDUCTORS. P.Baruch and P.Nozières.
J. Phys. Radium, Vol. 16, No. 7, 43 S - 44 S (July, 1955). In French.

A modification of the classical treatment of carrier mobility due to Conwell and Weisskopf is given, and assumes that the impurities are randomly distributed and that the electron moves in a field controlled by a "screening" effect of the ions. C.A.Hogarth

537.311.33

324. RESEARCHES ON THE SPECTRA OF VARIOUS SEMICONDUCTORS. S.Nikitine, L.Couture, G.Perny and S.Sieskind.
J. Phys. Radium, Vol. 16, No. 7, 42 S (July, 1955). In French.

537.311.33

325. ON THE SEMICONDUCTIVITY OF CRYSTALLINE AROMATIC SUBSTANCES. A.Many, E.Harnik and D.Gerlich.
J. chem. Phys., Vol. 23, No. 9, 1733-4 (Sept., 1955).

A rough correlation is found between carrier mobility and activation energy for semiconduction in many different aromatic compounds. The mobility varies over a very wide range from 10^{-12} to 10^2 cm^2/volt. sec, and is assumed to depend on electron tunnelling through intermolecular boundaries. G.F.J.Garlick

537.311.33

326. DISTRIBUTION FUNCTION OF SEMI-CONDUCTOR NOISE. D.A.Bell.
Proc. Phys. Soc. B, Vol. 68, Pt 9, 690-1 (Sept., 1955).

Describes an experimental confirmation that the distribution in amplitude of the current noise from a carbon resistor is Gaussian, as is usually assumed. A.H.W.Beck

537.311.33

327. RADIATIVE TRANSITIONS IN SEMICONDUCTORS. R.Braunstein.
Phys. Rev., Vol. 99, No. 6, 1892-3 (Sept. 15, 1955).

Minority carriers were introduced into 0.02 in. thick samples of GaSb, GaAs, InP and Ge—Si alloys, by contact injection, and the recombination radiation measured using a cooled PbS cell as detector. The radiation peaks were near the values corresponding to the energy gaps of the materials but did not correspond exactly. C.A.Hogarth

537.311.33

328. CARRIER CONCENTRATION DISTURBANCES IN SEMICONDUCTORS. R.E:Burgess.
Proc. Phys. Soc. B, Vol. 68, Pt 10, 793 (Oct., 1955).

Some features of the discussion in a paper by Low (Abstr. 5406/1955) are discussed. C.A.Hogarth

537.311.33

329. PLASMA RESONANCE IN CRYSTALS: OBSERVATIONS AND THEORY. G.Dresselhaus, A.F.Kip and C.Kittel.
Phys. Rev., Vol. 100, No. 2, 618-25 (Oct. 15, 1955).

Observations are reported of an electron plasma resonance absorption line in a magnetic field in an n-type crystal of InSb at 9000 and 24 000 Mc/s and at 4° and 77°K. The magnitude of the plasma frequency and its dependence on r.f. frequency and on the orientation of the figure axis of the speci-

men relative to the static magnetic field are in approximate agreement with the elementary theory of the plasma resonance developed previously by the authors. The line shape is discussed for experiments carried out under conditions of carrier modulation and magnetic field modulation. A theoretical discussion is given of the effects of specimen shape and of the possibility of detection of minority-carrier cyclotron resonance in the presence of a majority-carrier plasma. Eddy current effects are discussed, with reference to the possibility of the detection of cyclotron resonance in metals and semimetals. A.

537.311.33

330. OBSERVATION OF QUANTUM EFFECTS IN CYCLOTRON RESONANCE. R.C.Fletcher, W.A.Yager and F.R.Merritt.
Phys. Rev., Vol. 100, No. 2, 747-8 (Oct. 15, 1955).

Extra positive-hole lines appear when Ge is cooled from 4.2°K to 1.3°K, confirming the prediction of Luttinger and Kohn (Abstr. 1813/1955) that states of low quantum number in degenerate bands will behave non-classically. R.G.Chambers

537.311.33 : 535.345

331. THEORY OF THE INFRARED ABSORPTION BY CARRIERS IN SEMICONDUCTORS. R.B.Dingle.
Phys. Rev., Vol. 99, No. 6, 1901-2 (Sept. 15, 1955).

It is pointed out that the magnitude of the infrared absorption in Ge and Si calculated by Kahn (Abstr. 4653/1955) should be supplemented by a term arising from the anomalous nature of the skin effect. The magnitude of the correction is discussed and it is shown that it could be appreciable. D.G.Avery

537.311.33 : 537.533.2

332. FIELD EMISSION FROM SEMICONDUCTORS. R.Stratton.
Proc. Phys. Soc. B, Vol. 68, Pt 10, 746-57 (Oct., 1955).

The field emission current from a simple semiconductor has been evaluated in a manner similar to that employed by Fowler and Nordheim for a metal. It is shown that special effects will be associated with the state of the semiconductor surface. The presence of an appreciable number of surface states should give very low currents until fields high enough to break down the internal barrier are applied. When this occurs, or if there are no surface states at all, the field will penetrate into the semiconductor and lead to a lowering of the conduction band edge. This causes degeneracy in the electron distribution near the surface region and a greatly enhanced emission not unlike that of a metal. It is pointed out that the current/field emission characteristic dominated by surface states should be strongly temperature dependent while that dominated by field penetration is not. The limits of applicability for the various results are indicated. A.

537.311.33 : 538.63

333. THE GALVANOMAGNETIC EFFECTS IN SEMICONDUCTORS. O. Madelung.
Naturwissenschaften, Vol. 42, No. 14, 406-10 (1955). In German.

A general article in which the Hall effect, magnetoresistance, the Corbino disc, and size effects are considered. The corresponding properties of intrinsic semiconductors are discussed, and the longitudinal Hall effect observed in anisotropic conductors is described. The behaviour of the magnetic rectifier (Weisshaar and Welker) is explained, and modifications to the various properties as a result of thermal gradients are briefly considered. C. A. Hogarth

537.311.33 : 538.632

334. HALL EFFECT NOISE. J.J.Brophy and N.Rostoker.
Phys. Rev., Vol. 100, No. 2, 754-6 (Oct. 15, 1955).

By the use of a measured field-dependent noise voltage at the Hall electrodes of germanium crystals, it is shown that the charge carrier density fluctuations are sufficient to account for the observed 1/f noise. C.A.Hogarth

537.311 33

335. STUDY OF THE FREQUENCY DISPERSION OF THE CONDUCTIVITY OF BORON AND OF $B_{12}Al$. J.Lagrenaudie.
J. Phys. Radium, Vol. 16, No. 8-9, 731-2 (Aug.-Sept., 1955). In French.

Measurements of the electrical conductivity of cast specimens of boron and $B_{12}Al$ as functions of frequency in the range 100 c/s to 1 Mc/s, and of temperature in the range 110°K to room temperature. The dispersion effects are greater at the lower temperatures. The results are examined in terms of a granular model of a semiconductor. C.A.Hogarth

537.311.33

336. SURFACE RECOMBINATION OF CADMIUM SULFIDE. S.H.Liebson.
J. chem. Phys., Vol. 23, No. 9, 1732 (Sept., 1955).

Luminescence and photoconduction in CdS crystals show a fall-off in efficiency with increasing pressure of surrounding oxygen. Similar results occur with increasing pressure of ammonia in the system. Recovery in vacuo from oxygenation is accelerated by ultraviolet light, and it is assumed that this liberates positive holes which move to the surface to combine with chemisorbed oxygen forming free oxygen atoms which desorb. G.F.J.Garlick

537.311.33

337. NATURE OF THE WATER-VAPOR-INDUCED EXCESS CURRENT ON GROWN GERMANIUM P-N JUNCTIONS. E.N.Clarke.
Phys. Rev., Vol. 99, No. 6, 1899-900 (Sept. 15, 1955).

The excess-current/reverse-voltage characteristics were measured for excess currents induced on thesame p-n junction by water vapour and by field effect. The similarity of the results obtained in the two cases suggests that the induced excess current is electronic rather than ionic. C.A.Hogarth

537.311.33

338. THEORY OF ACCEPTOR LEVELS IN GERMANIUM. W.Kohn and D.Schechter.
Phys. Rev., Vol. 99, No. 6, 1903-4 (Sept. 15, 1955).

Results of a theoretical calculation of the acceptor ionization energy in Ge assuming that the binding is largely due to the long-range Coulomb potential of the acceptors, yield a value of 0.0089 eV, slightly lower than but in good agreement with the experimental values for B, Al, Ga, and In as impurities. C.A.Hogarth

537.311.33

339. MINORITY CARRIER EXTRACTION IN GERMANIUM. R.Bray.
Phys. Rev., Vol. 100, No. 4, 1047-59 (Nov. 15, 1955).

The concentration of minority carriers in a sample can be effectively decreased below its equilibrium value by an extraction process in which, (a) the minority carriers in the sample are swept out by an electric field in a time much less than the lifetime, while (b) the minority carrier flow into the sample at the entry contact, is suppressed. Procedures are discussed for making contacts satisfying condition (b). Such contacts have low resistance, and give photovoltages of opposite polarity to that of injecting contacts. With increasing field during extraction, there is a saturation increase of sample resistance, corresponding to approximately complete minority carrier depletion. Saturation extraction suppresses the intrinsic decrease in resistivity for a range of some 50° C for a group of p-type samples with resistivities of 7 to 40 ohm.cm at 300°K. Limitations on the range of effectiveness of extraction are imposed by failure of conditions (a) and (b) to hold at higher temperatures and/or deeper in the intrinsic range. Transport and transient effects associated with extraction can be used, as with injection, for measurement of

minority carrier mobility and lifetime. Extraction is further useful for controlling collector properties, and for determining the composition of reverse current of point-contact rectifiers, in terms of hole and electron components. A.

537.311.33

340. LONGITUDINAL PHOTOMAGNETOELECTRIC EFFECT IN GERMANIUM. J.Aron and G.Groetzinger.
Phys. Rev., Vol. 100, No. 4, 1128-9 (Nov. 15, 1955).

The e.m.f. developed parallel to the gradient of light absorption (Dember e.m.f.) in a germanium crystal is reduced by the application of a transverse magnetic field, the diminution being about 10% for a field of 5000 gauss. The size of the effect is approximately quadratic in the field up to about 2000 gauss, is then linear to 4000 gauss, and subsequently saturates. A.

537.311.33

341. PROPERTIES OF GERMANIUM DOPED WITH MANGANESE. H.H.Woodbury and W.W.Tyler.
Phys. Rev., Vol. 100, No. 2, 659-62 (Oct. 15, 1955).

The temperature dependence of the electrical resistivity and Hall coefficient in p- and n-type manganese-doped germanium crystals indicates that manganese introduces two acceptor levels in germanium at 0.16 ± 0.01 eV from the valence band and 0.37 ± 0.02 eV from the conduction band. The distribution coefficient for manganese in germanium is $(1.0 \pm 0.2) \times 10^{-6}$. Comparison is made with other fourth-row metals (V, Fe, Co and Ni) as impurities in germanium. A.

537.311.33

342. ELECTRICAL PROPERTIES OF GERMANIUM–SILICON ALLOYS. A.Levitas.
Phys. Rev., Vol. 99, No. 6, 1810-14 (Sept. 15, 1955).

Resistivity measurements have been performed from 300° to 800°K on homogeneous alloys and the intrinsic lines have been established. Hall and resistivity measurements have been performed on p-type alloys from 77° to 300°K. The variation of mobility with composition of the alloy is indicative of alloy scattering. A.

537.311.33 : 537.312.8

343. MAGNETORESISTANCE OF GERMANIUM–SILICON ALLOYS. M.Glicksman.
Phys. Rev., Vol. 100, No. 4, 1146-7 (Nov. 15, 1955).

Magnetoresistance measurements of n-type germanium–silicon single crystals reveal a change in band structure occurring at about 14% silicon content. For silicon contents of less than 8%, the magnetoresistance is that of a crystal with ellipsoidal conduction minima along [111] axes in reciprocal lattice space. In the region 11-14% silicon, the magnetoresistance changes toward that expected for a crystal with ellipsoidal conduction minima along [100] axes. The results agree with Herman's speculations on the alloy band structure. A.

537.311.33 : 537.32

344. THE ELECTRIC AND THERMOELECTRIC PROPERTIES OF INDIUM ANTIMONIDE. J. Tauc and M. Matyáš.
Czech. J. Phys., Vol. 5, No. 3, 369-88 (Aug., 1955). In Russian, with summary (4 pp.) in English.

The electrical conductivity, Hall constant, and thermoelectric power are reported as functions of temperature for p-type crystals made by refining, and for n-type specimens made by doping p-type crystals with Se. Results in general agree with those obtained elsewhere. The position of the Fermi level is obtained from an analysis of thermoelectric data. The n-type samples are degenerate over the whole temperature range; the p-type samples at high temperatures (when intrinsic). From analysis of the experimental data the electron effective mass is found to be $(3.6 \pm 0.1) \times 10^{-2}$ m, and independent of temperature in the range 150 to 700°K. The effective mass of holes cannot be uniquely determined from the data without additional experimental information; and may well vary with temperature. Donor impurities probably have no definite activation energy, but the donor levels form a band which overlaps the conduction band. C. A. Hogarth

537.311.33 : 537.32

345. THERMOELECTRIC POWER OF INDIUM ANTIMONIDE. H.P.R.Frederikse and E.V.Mielczarek.
Phys. Rev., Vol. 99, No. 6, 1889-90 (Sept. 15, 1955).

Thermoelectric power θ, Hall coefficient, and electrical conductivity were measured on n- and p-type specimens over the temperature range 60-400° K. Taking the ratio of effective masses of electrons and holes to be 0.11 the experimental values of θ v. T fit theoretical curves based on the theory due to Johnson and Lark-Horovitz very well. The "phonon-drag" effect is observed at low temperatures in p-type but not in n-type samples. C.A.Hogarth

537.311.33 : 535.345

346. INFRARED ABSORPTION IN INDIUM ANTIMONIDE. W.G.Spitzer and H.Y.Fan.
Phys. Rev., Vol. 99, No. 6, 1893-4 (Sept. 15, 1955).

The transmission and reflectivity of crystals of InSb have been measured from 5 to 150 μ, at sample temperatures between 297°K and about 5°K. Two absorption bands are found at 28.2 and 30 μ, whose intensity is independent of impurity concentration between 10^{15} and 10^{17} centres cm^{-3}. Reflectivity measurements show another absorption band at 52 μ at 297°K and 78°K and high absorption beyond 100 μ at room temperature. The 52 μ band is again independent of carrier concentration, but the long-wave absorption is thought to be due to conduction electrons. Study of the 52 μ band suggests some degree of ionic binding in the lattice, with an effective ionic charge of 0.34e. D.G.Avery

537.311.33 : 548.53

347. PREPARATION AND ELECTRICAL PROPERTIES OF InP AND GaAs. O.G.Folberth and H.Weiss.
Z. Naturforsch., Vol. 10a, No. 8, 615-19(Aug., 1955). In German.

Some of the precautions necessary in the zone-melting of these compounds are described. The conductivity and Hall effect as functions of temperature are reported for both compounds and the optical absorption data of various workers are summarized. The mobility–temperature data are discussed and related to scattering processes. The energy gaps are found to be approximately 1.2-1.4 (InP) and 1.25-1.35 (GaAs). C.A.Hogarth

537.311.33

348. EFFECTS OF OXYGEN ON PbS FILMS. H.T.Minden.
J. chem. Phys., Vol. 23, No. 10, 1948-55 (Oct., 1955).

The effect of oxygen on the conductivity of vacuum-evaporated PbS films has been experimentally investigated. When outgassed these films are n-type semiconductors. If they are exposed to oxygen at temperatures below about 200°C, the conductivity decreases with increasing pressure and then increases again. The thermoelectric power changes from negative to positive, but less than 10^{-3} moleO_2/molePbS is sorbed by the film. Above 200°C the conductivity merely decreases when oxygen is admitted, and the thermoelectric power becomes small. The film gradually absorbs all the oxygen in the vacuum system and evolves a good deal of SO_2. When the reaction is complete, the conductivity returns to its initial value, and the thermoelectric power is once again negative. The film can repeatedly absorb large amounts of oxygen without there being any permanent change in electrical properties. It is concluded that these films are composed of two layers. Next to the substrate there is a conducting layer that chemisorbs oxygen but does not react with it. The chemisorbed oxygen acceptors are responsible for the observed changes in conductivity. The upper layer of the film is nonconducting and reacts to completion with oxygen, possibly

forming $PbSO_3$, PbO, and evolving SO_2. A.

537.311.33

349. MEASUREMENTS ON P-N JUNCTIONS IN LEAD SULPHIDE. T.S.Moss.
Proc. Phys. Soc. B, Vol. 68, Pt 10, 697-700 (Oct., 1955).

From measurements of the characteristics of several natural p-n junction the intrinsic resistivity of lead sulphide is calculated to be 3.1 ohm.cm. Hence at room temperature the intrinsic carrier concentration is 2.7×10^{18} electrons or holes per cm^3 and the width of the forbidden zone 0.40 eV. A.

537.311.33

350. D.C. RESISTIVITY IN THE NICKEL AND NICKEL ZINC FERRITE SYSTEM. L.G.Van Uitert.
J. chem. Phys., Vol. 23, No. 10, 1883-6 (Oct., 1955).

The dependence of the resistivities of nickel and nickel zinc ferrites prepared from high-purity reagents upon composition and firing temperature has been studied. It has been determined that iron-deficient nickel–zinc ferrites are of much higher resistivity than iron-deficient nickel or zinc ferrites. The iron-deficient ferrites prepared, which were fired in oxygen below 1300°C and have Ni : Zn ratios greater than 3 : 7, show a positive thermoelectric voltage. Other compositions or materials fired above 1300°C have a negative thermoelectric voltage. The effect of excess iron upon resistivity is dependent upon the presence or absence of zinc at temperatures below 1300°C. A.

537.311.33 : 548.7

351. TRAPPING OF MINORITY CARRIERS IN SILICON. II. N-TYPE SILICON. J.R.Haynes and J.A.Hornbeck.
Phys. Rev., Vol. 100, No. 2, 606-15 (Oct. 15, 1955).

For Pt I, see Abstr. 2750 (1955). Experimental evidence of temporary trapping of holes in the volume of n-type silicon in at least two different traps is presented. The trap parameters of cross-section for capture and energy level above the valence band are determined by measuring the unfilled trap density, the hole density, the rate at which holes are trapped, and the rate at which holes are released from traps. Measurement of the temperature dependence of these quantities for the deeper traps gives, in addition, the temperature variation of the cross-section for capture, the energy level of the traps below the conduction band and a second determination of the trap level above the valence band. The values obtained are consistent with accepted values of the energy gap. There is evidence for a loss mechanism for holes (recombination) from the deeper traps at a rate which is found to be proportional to the square of the electron concentration. A

537.311.33

352. ELECTRICAL PROPERTIES OF NEAR-DEGENERATE BORON-DOPED SILICON. R.O.Carlson.
Phys. Rev., Vol. 100, No. 4, 1075-8 (Nov. 15, 1955).

Measurements of extrinsic resistivity and Hall effect have been carried out for a group of single crystals of silicon containing a wide range of boron concentration, with particular stress on samples in the near-degenerate range, 10^{18} to 10^{19} boron atoms per cm^3. The anomalous Hall mobility effect previously observed by Morin and Maita in silicon was studied in finer detail over the temperature range 25°K to 300°K. For degenerate samples the 300°K Hall mobility is approximately 46 cm^2/volt.sec. A.

537.311.33

353. LIFETIME OF ELECTRONS IN p-TYPE SILICON. G.Bemski.
Phys. Rev., Vol. 100, No. 2, 523-4 (Oct. 15, 1955).

The dependence of lifetime of electrons on temperature in p-type silicon can be explained on the basis of the Shockley–Read–Hall theory by assuming a level for the recombination centres at 0.2 eV from the valence band. The variation of lifetime with injected carrier density can also be explained by the same model. A.

537.311.33

354. THE ELECTRICAL CONDUCTION OF (COMPRESSED) TABLETS OF NaCl AND KBr. J.Boros and S.Császár.
Acta phys. Hungar., Vol. 5, No. 1, 33-50 (1955). In German.

Semiconduction activation energies are determined from conductivity/temperature measurements and agree closely both with those obtained earlier (Abstr. 6601/1954) and with optical values. It is suggested that some electronic conduction occurs even in the uncoloured alkali halides. J.E.Caffyn

537.311.33

355. RECOMBINATION PROCESSES IN TELLURIUM. D.Redfield.
Phys. Rev., Vol. 100, No. 4, 1094-100 (Nov. 15, 1955).

Recombination processes in tellurium have been investigated, chiefly by use of the techniques of photoconductivity. Studies were made on single crystals having acceptor densities of about 10^{16} per cm^3. By using pulsed illumination, the decay time constant of photocurrent was found to be 20 microsec, in fairly good agreement with results obtained previously from steady-state photocurrent sensitivity. The interpretation of the results of the various photoconductivity experiments leads to the conclusion that in Te at 100°K direct combination dominates over recombination through localized centres (traps) at all light intensities. To explain this unusual result, it is proposed that as a rule in small-energy-gap materials traps should be relatively ineffective as agents of recombination. It follows that small-gap materials should have long lifetimes; thus they should usually be sensitive photoconductors. Furthermore, since the direct recombination probability increases as the gap becomes narrower, there should be some optimum value of energy gap (probably near 0.5 eV) that will give rise to the longest realizable lifetimes. Some confirming data on other materials are cited in support of this proposal. An attempt to observe radiation which may be emitted in the recombination process was unsuccessful, possibly because of experimental limitations. A.

537.311.33

356. MANGANESE IMPURITY CENTRES IN GREY TIN. G.Busch and K.A.Müller.
Helv. phys. Acta, Vol. 28, No. 4, 319-20 (1955). In German.

The Hall effect/temperature relation was measured for specimens of grey tin containing decreasing quantities of manganese. For large additions the specimens are p-type, for smaller additions they are n-type. The results, which agree with previous results of Busch and Mooser on magnetic susceptibility, suggest that manganese acts as a weak acceptor and is located at lattice sites. C.A.Hogarth

537.311.33

357. ON THE TRANSIENT BEHAVIOR OF SEMICONDUCTOR RECTIFIERS. B.R.Gossick.
J. appl. Phys., Vol. 26, No. 11, 1356-66 (Nov., 1955).

If the forward current through a p-n junction suddenly ceases, an e.m.f. appears due to nonequilibrium carrier concentrations at the junction barrier. Measurements of the barrier e.m.f. have been made with a wide range of injection currents and yield current v. barrier voltage characteristic curves. The open circuit case of voltage decay across a p-n junction in the range V kT-q is discussed. The voltage decay is observed to be linear with time with a slope kT/q . It follows from an analysis based on a simple model that the excess minority carrier concentrations decrease exponentially with the time constant . The floating emitter and collector voltages, $V_E(t)$ and $V_C(t)$, of p-n-p transistors are observed to decay like the open circuit voltage across a p-n junction, and it is noted that $V_E(t) - V_C(t)$ in the range V kT q. The transient response of a semiconductor rectifier connected

in parallel with a large external capacitance is analysed. The response calculated for large negative excursions of voltage gives a simple relation by which the saturation current may be determined. Measurements are presented and discussed. A.

537.311.33

358. ON THE QUESTION OF THE STATIC RECTIFICATION CHARACTERISTICS OF GERMANIUM P-N JUNCTIONS. H. Frank.
Czech. J. Phys., Vol. 5, No. 3, 389-92 (Aug., 1955). In German.

Discussion of the value of the exponent α which characterizes the current–voltage characteristics and its temperature dependence. Theories given by Shockley and Hall respectively lead to values of e/kT and e/2kT for α. Experimental values tend to e/kT at low temperatures (−40° C) and to e/2kT at high temperatures (80° C). Reasons for the discrepancy are discussed. C. A. Hogarth

537.311.33

359. RATE-GROWN GERMANIUM CRYSTALS FOR HIGH-FREQUENCY TRANSISTORS. H.E.Bridgers and E.D.Kolb.
J. appl. Phys., Vol. 26, No. 9, 1188-9 (Sept., 1955).

N–P–N junctions were formed in Ge crystals grown from a melt doped with B and Sb, by periodically varying the rate of growth. By adjustment of impurity concentration and growth rate, transistors with p-layers of 0.1–0.3 mil were obtained, oscillating above 1000 Mc/s, and with a tetrode $\alpha = 0.95$ and a phase angle of 8° at 30 Mc/s. J.Franks

537.311.33

360. VISIBLE LIGHT FROM A SILICON p-n JUNCTION. R.Newman.
Phys. Rev., Vol. 100, No. 2, 700-3 (Oct. 15, 1955).

When low-voltage silicon p-n junctions are biased in the reverse direction to breakdown, visible light is emitted from the junction region. The effects of surface treatment on the phenomenon are discussed. Two typical light output v. reverse current curves are shown. A typical spectral distribution curve in the 1.8-3.4 eV range is shown. The observations suggest that the light results from a radiative relaxation mechanism involving the high-energy carriers produced in the avalanche breakdown process. A.

537.311.33

361. ON UNIPOLAR CONDUCTIVITY AT THE JUNCTION SEMICONDUCTOR–METAL. (CONDUCTIVITY MEASUREMENTS ON SILVER IODIDE.) E. Wallauschek.
Acta phys. Austriaca, Vol. 9, No. 3-4, 351-66 (1955). In German.

Experiments on the rectification of "cells" made by treating a disc of silver with iodine and making contact to the AgI with a Pt whisker. In each direction the current at a given applied voltage took some time to reach a steady value. The effects of temperature in the range 18 to 102° C and of contact thrust were investigated. The results are explained in terms of electrolytic conduction. C. A. Hogarth

537.311.35

362. A STUDY OF THE INFLUENCE OF TEMPERATURE ON THE CONDUCTIVITY OF LIQUID INSULATION. R.Guizonnier.
C.R. Acad. Sci. (Paris), Vol. 241, No. 10, 670-2 (Sept. 5, 1955). In French.

The variation of the initial conductivity of 18 materials (oils, waxes and pure liquids) with temperature was measured using nickel-plated copper electrodes 5 mm apart and field strengths not exceeding 2kV/cm. The results are expressible by equations of the form $i = A\exp(-B/T)$, where B, a constant, was the same for 12 substances, and was higher for 5 others, but decreased for these when the moisture content was decreased. CS_2 gave a deposit of sulphur. P.Cucka

537.311.35 : 537.528

363. CONDUCTION AND BREAKDOWN IN HEXANE. W.B.Green.
J. appl. Phys., Vol. 26, No. 10, 1257-65 (Oct., 1955).

Conduction currents in hexane, studied as a function of spacing, metal and heat treatment of the electrodes over the field-strength range from 0 to 250 kV/cm, obey neither a field-enhanced thermionic emission nor the customary field emission relation. The most important factor determining the currents appears to be a surface layer on the cathode. Exposing the liquid to gamma-rays increases the current in a fashion that indicates a decrease of the effective work function rather than merely a collection of ionization products. Heat treatment of the cathode, by changing the nature of the surface layer, changes the emission. It appears that positive ions collect on the more or less insulating surface layer and build up intense local fields that cause electron emission. The size of the local field depends on the number of the ions arriving per second and on the thickness, homogeneity, and conductivity of the surface layer. For some electrodes the current increases with gap width for constant field; previous investigators have interpreted this fact as evidence of impact ionization in the liquid. However, change of current with gap width proves to be an electrode property; some electrodes do not show it. In one case the current was measured up to breakdown (1060 kV/cm). There is an indication that impact ionization may exist above 800 kV/cm; if so, the ionization factor is very small. A variety of purification systems was tried but no influence of the purification treatment on the conduction currents was found. A.

537.311.35 : 541.133

364. STUDY OF THE CONDUCTIVITY OF CARBON TETRACHLORIDE (FIELDS LESS THAN 1500 V/cm). R.Guizonnier and P.Mourcin.
J. Phys. Radium, Vol. 16, No. 7, 56 S - 58 S (July, 1955). In French.

A cell with concentric nickel electrodes was used and the carbon tetrachloride was also studied in the dried condition. The results show the variations of current with time, the final current (after the voltage had been applied for a long time) with voltage, and the initial current with voltage. It is concluded that the conductivity is due essentially if not exclusively to particles of water in the liquid. A.E.Kay

537.311.6

365. THE A.C. ADMITTANCE OF TEMPERATURE-DEPENDENT CIRCUIT ELEMENTS. R. E. Burgess.
Proc. Phys. Soc. B, Vol. 68, Pt 10, 766-74 (Oct., 1955).

The relation between the isothermal and steady-state current/voltage characteristics of a device in which the current depends on both the voltage and the temperature is deduced quite generally without assuming electrical linearity or Newtonian cooling. The phenomena of voltage turnover in a device with a positive temperature coefficient of d.c. conductance, and of current turnover in a device with a negative coefficient are deduced. The a.c. admittance for a small a.c. voltage superimposed on the d.c. voltage determining the operating point is derived in terms of the thermal admittance of the device, i.e. the complex ratio of the alternating components of power and temperature. For the special case in which the thermal admittance consists of a shunt combination of a fixed thermal capacity and thermal conductance the electrical admittance has been evaluated in detail. Three-element equivalent circuits (of two resistors and a capacitor or inductor) can represent the electrical admittance of such a device and its locus is semicircular; the reactive element represents the effect of thermal inertia and its nature is determined by the sign of the temperature coefficient of d.c. conductance. Where heat loss from the device is by a path which is not 'thermally short' at the frequency under consideration the thermal admittance no longer has a simple form but has to be determined from the

diffusion equation. This is done for the case of one-dimensional heat conduction (e.g. along the supporting wires of a thermistor or a lamp) or for radial heat flow (e.g. from the contact in a point-contact rectifier). The general condition for the admittance locus still to be circular, but with the centre not on the conductance axis, is formulated. A.

537.312.5

366. BARRIER-LAYER PHOTOCELLS. II. A.Kellermann. Arch. tech. Messen, Issue No. 229 (Ref. J 392-3) 45-8 (Feb., 1955). In German.

For Pt I, see Abstr. 6144 (1955). Brief descriptions, with characteristics, of Se cells for the near infrared, cells with artificial barrier layers (e.g. MgO, CaF_2), silver bromide and sulphide cells. 55 refs. A.H.W.Beck

537.312.5

367. PHOTOELECTRIC EMISSION FROM POLYCRYSTALLINE GRAPHITE. E.Taft and L.Apker.
Phys. Rev., Vol. 99, No. 6, 1831-2 (Sept. 15, 1955).

Energy distribution of the photoelectrons from polycrystalline graphite was measured by retarding-potential methods in spherical phototubes with small, central, interchangeable emitters. There were distinct deviations from metallic behaviour. The results were consistent with a density of states that was relatively small at the Fermi level and that rose to a value several-fold higher 1 eV away. The photoelectric yield from graphite is about ten times below that of common metals. A.

537.312.5

368. PHOTOELECTRIC YIELDS IN THE VACUUM ULTRAVIOLET. W.C.Walker, N.Wainfan and G.L.Weissler.
J. appl. Phys., Vol. 26, No. 11, 1366-72 (Nov., 1955).

Absolute photoelectric yields of Ni, Cu, Pt, Au, W, Mo, Ag and Pd are presented for the spectral region from 1400 to 473 A. Measurements were obtained for commercially pure polycrystalline surfaces which were treated in various ways including heat treatment in vacuo and in various gas atmospheres at reduced pressures. Surfaces, heat treated in vacuo, gave reproducible yields ranging from 10^{-3} electrons per photon at 1400 A to 10^{-1} electrons per photon at 500 A. Although untreated samples exhibited a maximum in the region studied, this maximum disappeared after heat treatment resulting in most cases in a broad plateau extending from 1000 A to 500 A. At wavelengths longer than 1000 A a decrease in yield was observed. Representative experiments with a Ni cathode, heat treated in vacuo then exposed to O_2 at reduced pressures, indicated that the maxima for untreated surfaces were caused by adsorbed gases and metallic oxide formation. The absolute error in the values of the photoyields was estimated to be within ± 15%. A.

537.312.5 : 621.383.27

369. HYSTERESIS EFFECT IN MULTIPLIER PHOTOTUBE NOISE. C.A.Ziegler and H.H Seliger.
J. appl. Phys., Vol. 26, No. 10, 1225-8 (Oct., 1955).

A hysteresis effect in noise as a function of tube gain has been found for both RCA 5819 and DuMont 6292 tubes. The effect is a function of both temperature and the length of time that a tube has "rested". The hysteresis is seen to be a noise build-up with time but not a change in dynode multiplication. The reasons for this effect are not clear. Several possible mechanisms are discussed. Conditions are determined for obtaining reproducible noise counts for liquid scintillation counting of low-energy beta-emitters. A.

537.312.62

370. NEW EXPERIMENTAL RESULTS IN SUPERCONDUCTIVITY. W. Buckel.
Naturwissenschaften, Vol. 42, No. 16, 451-8 (1955). In German.

A brief review of recent progress (115 references, mostly since 1952). D. Shoenberg

537.312.62

371. INFLUENCE OF A CIRCULAR CLOSED MAGNETIC FIELD ON THE SUPERCONDUCTIVE STATE OF A MONOCRYSTALLINE HOLLOW LEAD CYLINDER. M.Näbauer.
Z. Phys., Vol. 141, No. 4, 416-44 (1955). In German.

A lead single crystal in the shape of a thin-walled hollow cylinder with electropolished surface was provided with toroidal coils for producing a circular magnetic field and for measuring changes in flux. Because of the symmetry of the field, the transition from super- to normal conductivity takes place without passing through a complicated intermediate state and is accessible to calculation. The transition in a supercritical field and the time variation of the flux on switching on or off such a field were measured. Further, the change of the penetration depth with field strengths below critical were investigated. It was found that at fields greater than $H_c/8$ the penetration depth begins to increase. This effect, which shows hysteresis, is ascribed to surface imperfections. It is shown that, according to the London theory, the density of the screening current is increased at the base of a groove, and since the value of this current determines the onset of the transition, the base of a groove will become normal at subcritical fields. H.London

537.312.62

372. SUPERCONDUCTIVITY AND ELECTRIC RESISTANCE OF EVAPORATED BISMUTH LAYERS. N.Barth.
Z. Phys., Vol. 142, No. 1, 58-69 (1955). In German.

Thin Bi layers were produced by condensation at 4°K and the effect of the addition of other metals on the transition temperature and the electric resistance investigated. By means of these additions it is possible to stabilize the disordered lattice state for temperatures up to 200°K. It is this disordered state which causes superconductivity in Bi. The additions cause a decrease of the transition temperature, which is particularly marked for Mn, Fe, Cr. The dependence of the transition temperature on the concentration of these additions is interpreted on the basis of the paramagnetic properties of these transition metals. H.London

537.312.62

373. EFFECTS OF STRESS ON SUPERCONDUCTING Sn, In, Tl and Al. N.L.Muench
Phys. Rev., Vol. 99, No. 6, 1814-20 (Sept. 15, 1955).

Hydrostatic pressures of 0 to 100 atm obtained with helium gas pressure, and of 1.9×10^3 atm obtained by an ice expansion bomb technique are used to measure the pressure displacement of critical temperature T_c. The coefficient $(\partial T_c/\partial\ )$ for Sn, In, Tl and Al is -4.7 ± 0.2, -4.0 ± 0.2, $+0.6 \pm 0.3$, and -2.0 ± 0.2 in units of 10^{-5} deg K/atm, respectively. The temperature dependence of

$$R = (\partial H_c/\partial p)_T/(\partial H_c/\partial p)T_c$$

above 1°K is described by $R = 0.61 + 0.029T^2$ for Sn, and $R = 0.77 + 0.020T^2$ for In. This result is discussed in connection with the similarity principle, H_o/T_c = constant. From an analysis combining stress and isotope effects, it is seen that T_c, or H_c, is more sensitive to volume changes, holding zero-point lattice vibration amplitude fixed, than to zero-point amplitude changes, holding V fixed: $(\partial H_c/\partial \ln V)_{q^2} = 5.5 \times (\partial H_c/\partial \ln q^2)_V$ for Sn. Zero-pressure critical field data are also presented for these metals. A.

537.312.62

374. SUPERCONDUCTIVITY OF ZIRCONIUM ALLOYS. B.T.Matthias and E.Corenzwit.
Phys. Rev., Vol. 100, No. 2, 626-7 (Oct. 15, 1955).

The superconducting transition temperatures of alloys between zirconium and VIIIth column elements are substantially higher than those of zirconium. The same is true of zirconium–gold alloys. This observation confirms a rule previously established about the height of transition temperatures. A.

537.312.62

375. FIELD THEORETICAL DESCRIPTION OF THE SUPERCONDUCTING STATE. R.E.Pugh
Canad. J. Phys., Vol. 33, No. 11, 679-92 (Nov., 1955).

The superconducting state is described in terms of the electronic plasma in interaction with the electromagnetic potentials. The interaction of the plasma with itself and with the lattice is represented by a potential energy determined such that the equations of motion are self-consistent. The resulting non-linear field equations are solved in the linear approximation. There exist four independent modes of vibration of the field variables corresponding to the plasma oscillations, and one longitudinal and two transverse oscillations of the electromagnetic potentials. The contribution of these modes to the specific heat is discussed. A.

537.312.62 : 538.632

376. SEARCH FOR THE HALL EFFECT IN A SUPERCONDUCTOR. II. THEORY. H.W.Lewis.
Phys. Rev., Vol. 100, No. 2, 641-5 (Oct. 15, 1955).

For Pt I, see Abstr. 2445 (1954). Various theoretical explanations for the absence of a Hall effect in a superconductor are considered, and none are found convincing. It is concluded that this property lies outside the existing body of theory, and the general requirements it imposes on a future theory are adduced. A.

537.312.62 : 539.37

377. THERMODYNAMICS OF A SHEARED SUPERCONDUCTOR. A.B.Pippard.
Phil. Mag., Vol. 46, 1115-18 (Oct., 1955).

Discusses the possibility of spontaneous shear of a single crystal when it becomes superconducting and also the changes in rigidity modulus in passing below the transition point. These considerations are related to experiments of Olsen (Abstr. 4680/1955) and Landauer (Abstr. 571/1955). D.Shoenberg

537.312.7

378. MODULATION OF THE ELECTRICAL CONDUCTIVITY BY SURFACE CHARGES IN METALS. G.Bonfiglioli, E.Coen and R.Malvano.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 334-5 (Aug., 1955).

Preliminary measurements of conductivity modulation of thin flat metal specimens by large capacitively-applied electric fields. Hysteresis and non-linear effects are observed. The surface charge mobility is small. In Au and Sb an increase in electron density causes a linear conductivity increase, in Bi the conductivity decreases. C.A.Hogarth

537.312.8

379. SINGLE BAND MOTION OF CONDUCTION ELECTRONS IN A UNIFORM MAGNETIC FIELD. P.G.Harper.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 874-8 (Oct., 1955).

The effect of a uniform magnetic field on the conduction band of a metal is investigated, using as model the tight-binding approximation for a simple cubic crystal. The normally discrete magnetic levels pertaining to free electrons are shown to be non-uniformly spaced and broadened as a result of the lattice forces. A.

537.312.8

380. THE GENERAL MOTION OF CONDUCTION ELECTRONS IN A UNIFORM MAGNETIC FIELD, WITH APPLICATION TO THE DIAMAGNETISM OF METALS.
P.G.Harper.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 879-92 (Oct., 1955).

Using translational properties of the Hamiltonian, a standard form is derived for the wave-functions describing conduction electrons moving in a uniform magnetic field. This is used to obtain a solution of the Schrödinger equation in order to examine the magnetic energy levels. For non-overlapping bands the notion of effective mass is shown adequate (neglecting level broadening) but in an overlap region neighbouring bands interact strongly and distort the single band levels. A brief application to the diamagnetism of metals is considered. A.

537.312.8 : 536.48

381. OSCILLATORY GALVANOMAGNETIC PROPERTIES OF ANTIMONY SINGLE CRYSTALS AT LIQUID HELIUM TEMPERATURES. M.C.Steele.
Phys. Rev., Vol. 99, No. 6, 1751-9 (Sept. 15, 1955).

Measurements of the Hall coefficient and transverse magnetoresistance have been made on antimony single crystals at liquid helium temperatures and in magnetic fields up to 25 kilogauss. Both these properties exhibit oscillations which are periodic in reciprocal magnetic field. For a given orientation of the crystal axes relative to the magnetic field, the period of oscillation is the same for both these galvanomagnetic effects. The observed periods are in good agreement with the values found in the de Haas–van Alphen effect of antimony. The magnetic field dependence of the Hall coefficient was also examined at 78°K and 300°K. It was found that at 78°K the Hall coefficient already exhibits marked field dependence. Small amounts of impurities were found to have a marked effect on both the magnitude and field dependence of the Hall coefficient at low temperatures. A.

537.312.9

382. EFFECT OF PRESSURE ON THE ELECTRICAL RESISTANCE OF METALS AT LIQUID HELIUM TEMPERATURES. J.Hatton.
Phys. Rev., Vol. 100, No. 2, 681-4 (Oct. 15, 1955).

The effect of pressures up to 5000 kg/cm^2 on the electrical resistance of polycrystalline copper, silver, gold and platinum and on single crystals of arsenic, antimony and bismuth has been measured at liquid helium temperatures. The pressures were generated by a piston and cylinder arrangement using solid hydrogen as the pressure transmitting medium. A.

537.312.9 : 537.32

383. RESISTIVITY AND THERMOELECTRIC POWER OF METALS CONTAINING GRAIN BOUNDARIES. F.Abelés.
J. Phys. Radium, Vol. 16, No. 7, 34 S - 35 S, (July, 1955). In French.

Estimates of the resistance and thermoelectric power increase in metals due to the plastic deformation which occurs at grain boundaries, and of the analogous problem of the resistivity and thermoelectric power of alloys of monovalent metals. C.A.Hogarth

537.322.3

384. MEASUREMENTS OF THE HOMOGENEOUS THERMOELECTRIC EFFECT OF THE THIRD DEGREE. (FIRST BENEDICKS EFFECT). G.Kocher.
Ann. Phys. (Leipzig), Vol. 16, No. 5-8, 210-26 (1955). In German.

Very careful measurements using high-purity annular specimens of Pt, Au, and Ag confirm the existence of the Benedicks effect and provide standard data. If there is a temperature gradient along a homogeneous ring-shaped specimen a thermo-e.m.f. is developed and is proportional to the cube of the temperature gradient. The sign of the effect is the same as for the Thomson coefficient for the same material. C.A.Hogarth

537.322.3

385. REMARKS ON THE FIRST BENEDICKS EFFECT. W.Meissner.
Ann. Phys. (Leipzig), Vol. 16, No. 5-8, 227-8 (1955). In German.

See preceding abstract. Speculations on the origin of the effect. C.A.Hogarth

537.362 : 545.84

386. PHENOMENOLOGICAL RELATIONS OF ELECTRO-OSMOSIS IN PAPER ELECTROCHROMATOGRAPHY. S.E.Wood.
J. chem. Phys., Vol. 23, No. 10, 1881-2 (Oct., 1955).

Phenomenological equations, based on the thermodynamics of irreversible processes have been developed for use when the electrodes are placed directly on or in the paper. A.

537.364

387. ELECTROKINETIC POTENTIALS OF BULK METALS BY STREAMING CURRENT MEASUREMENTS. I. METHOD. R.M.Hurd and N.Hackerman.
J. Electrochem. Soc., Vol. 102, No. 10, 594-7 (Oct., 1955).

A method for making a direct measurement of the stream-currents developed by fluid flow through metal capillaries is described, by means of which the electrokinetic (ζ) potentials of bulk metals can be determined. Experimental data proving the validity of the method are presented. A.

ELECTRIC DISCHARGES 537.52

537.523 : 537.56

388. GROWTH OF CURRENT BETWEEN PARALLEL PLATES. P.M.Davidson.
Phys. Rev., Vol. 99, No. 4, 1072-4 (Aug. 15, 1955).

The author's exact solution (Abstr. 6063/1953) of the mathematical problem of ionization current growth involving cathode secondary processes is here given in an alternative form which is more convenient for discussing the earliest stages of the growth. A.

537.523.3

389. PHOTOGRAPHS OF THE LIGHT PHENOMENA OF POSITIVE CORONA. R.Siksna.
Ark. Fys., Vol. 9, Paper 34, 555-60 (1955).

Cylindrical and point–plane geometry were used for discharges in air. Photographs of the discharges at various voltages are shown. J.D.Craggs.

537.525

390. INFLUENCE OF SURFACE FILMS ON JOSHI EFFECT IN WATER VAPOUR. N.A.Ramaiah, B.D.Khosla and H.C.Gaur.
Naturwissenschaften, Vol. 42, No. 17, 484-5 (1955).

Describes experiments on the effect of external irradiation, with visible light, on a.c. corona in water vapour and the influence on such discharges of surface films on the internal walls of the Siemens ozonizer tubes used for the experiments. J.D.Craggs

X-RAYS 537.531

537.531 : 535.33.07

391. BENT MICA FOCUSING X-RAY SPECTROGRAPH FOR A COURSE IN ATOMIC PHYSICS. J.W.Weymouth and N.Bauer.
Amer. J. Phys., Vol. 23, No. 8, 510-14 (Nov., 1955).

Describes a simple bent mica X-ray spectrograph that was built for use in a senior course. The theory and construction of the spectrograph are discussed and its application to the study of the properties of X-rays by means of the recording of direct and fluorescent radiations is described. A.

537.531 : 535.331

392. THE X-RAY SPECTRA OF μ-MESONIC COPPER AND LEAD. F.D.S.Butement.
Phil. Mag., Vol. 46, 1136-9 (Oct., 1955).

The energies of the 2P–1S radiative transitions were measured using a NaI scintillation counter. Curves are given of the pulse distributions from the scintillation counter, from these the X-ray energies were 1.55 and 5.84 MeV for Cu and Pb respectively. In neither case were the $2P_{\frac{1}{2}} - 1S$ and $2P_{\frac{3}{2}} - 1S$ components resolved. J.Hughes

537.531 : 535.345

393. SOFT X-RAY ABSORPTION OF TELLURIUM AND VITREOUS AND METALLIC SELENIUM. M.P.Givens, C.J.Koester and W.L.Goffe.
Phys. Rev., Vol. 100, No. 4, 1112-15 (Nov. 15, 1955).

The absorption of metallic selenium is compared with that of the vitreous form in the region from 200 A to 240 A. For these two forms of selenium and for tellurium, the absorption band is separated into two component bands. This has led to a revised estimate of 1.2 eV for the separation of the M_{IV} and M_V levels of selenium and 1.6 eV for the separation of the N_{IV} and N_V levels of tellurium. A.

537.531 : 535.371

394. SCINTILLATION CRYSTAL–TV DEVICE X-RAYS OBJECTS IN MOTION. J.S.Pruitt.
Nucleonics, Vol. 13, No. 8, 26-9 (Aug., 1955).

A 1 in. thick x $7\frac{1}{8}$ in. diameter NaI crystal acts as converter, to render visible an image produced by 50 MeV X-rays passing through the object under inspection. The optical image in the converter is viewed by a television camera and is displayed continuously on a remote screen. The resolution is poorer than that obtained with X-ray films, but there are possibilities of improvement. Image brightness was studied as a function of X-ray intensities and a table of crystal sensitivities at different X-ray energies is given. Discoloration of the crystal occurs after continuous exposure, but can be bleached out by sunlight. L.R.Shepherd

CATHODE RAYS. POSITIVE RAYS 537.533/.534

537.533 : 530.12

395. LECTURE DEMONSTRATION OF RELATIVISTIC BEHAVIOR OF ELECTRONS. M.Peter.
Amer. J. Phys., Vol. 23, No. 8, 515-17 (Nov., 1955).

A lecture demonstration is described, which allows verification of the relativistic relation between kinetic energy and momentum, $(mc^2 + E)^2 = m^2c^4 + c^2p^2$. Electrons are accelerated by a small high-voltage generator (van de Graaff, of approximately 250 kV) and deflected in a magnetic field of approximately 100 gauss. The measured values of high-voltage and deflecting magnetic field are plotted on a straight line which represents the relation given above. A.

537.533

396. ENERGY STABILITY OF THE 22-MeV BETATRON AT THE UNIVERSITY OF ILLINOIS. B.M.Spicer and A.S.Penfold.
Rev. sci. Instrum., Vol. 26, No. 10, 952-3 (Oct., 1955).

Data are presented on the short and long term energy stability. The data were taken in the course of a detailed study of the $O^{16}(\gamma, n)O^{15}$ yield curve. It is concluded that the machine was often stable to better than ±3 keV for periods of several hours and that the maximum energy fluctuation which was observed over an eighteen month period was 40 keV at 17 MeV. A.

537.533.3

397. ON THE MANNER IN WHICH MÖLLENSTEDT'S VELOCITY ANALYSER WORKS. W.Lippert.
Optik, Vol. 12, No. 10, 467-75 (1955). In German.

The dependence of the properties of Möllenstedt's elect-

on velocity analyser on the spacing of the electrodes, the ize of the apertures, and the value of the applied voltage is nvestigated. The attainment of optimum conditions for vari- us particular cases is illustrated by curves and numerical xamples. A.E.I.Research Laboratory

537.533.3

398. ON A METHOD FOR SYSTEMATICALLY CALCULAT- NG AN ELECTRON-OPTICAL POTENTIAL DISTRIBUTION VITH SPECIFIED IMAGING PROPERTIES. J.Picht. Optik, Vol. 12, No. 10, 433-40 (1955). In German.

The general equation of the trajectory of electrons in a nagnetic field is expressed in a simplified form, and condit- ons corresponding to fixed object and image points and to a pecified magnification are impressed upon it. It is shown hat a hyperbolic trajectory containing several free parameters onstitute a solution of the equation, and a method for deter- nining the shape of the polepieces needed to produce this is iven. Judicious choice of the free parameters may be used o minimize aberrations. A.E.I.Research Laboratory

537.533.3

399. THE WAVE-MECHANICAL THEORY OF ELECTRON- OPTICAL IMAGING. II. W.Glaser and G.Braun. Acta phys. Austriaca, Vol. 9, No. 3-4, 267-96 (1955). In German.

The general theory developed in Pt I (Abstr. 3816/1955) is now applied to the calculation of the wave-mechanical intensity distribution in the paraxial region of a rotationally symmetric- al electromagnetic field. The behaviour of the wave function in the Fraunhofer plane and its immediate neighbourhood is first discussed ("strong diffraction") and expressions are then derived for the components of the wave function at points suf- ficiently far from the Fraunhofer plane ("weak diffraction"), in the directly illuminated field, in the shadow and at the shad- ow boundary as given by geometrical optics. The geometrical- optical part of the wave function is described by a series which can also be obtained from the treatment of optical diffraction due to Bremmer (Abstr. 8095/1952). By means of this series it can be shown that the image formed by the paraxial region of an electromagnetic field of rotational symmetry is stigmatic in the Gaussian image plane. The diffraction part of the wave function is represented by a series of integrals over the edge of the aperture. It is shown how these integrals can in princi- ple be evaluated by the method of stationary phase for points which lie (a) far enough from the shadow boundary, (b) in the neighbourhood of the shadow boundary, and (c) at the shadow boundary. The imaging of an infinite slit, a straight edge, an angular corner and a circular aperture is discussed in turn. V.E.Cosslett

537.533.3

400. SPACE-CHARGE EFFECTS IN ELECTRON OPTICAL SYSTEMS. K.T.Dolder and O.Klemperer. J. appl. Phys., Vol. 26, No. 12, 1461-71 (Dec., 1955).

Beams consisting of charged particles which are all di- rected towards a given virtual focus will generally not reach this focus but, due to their mutual repulsion, they will pass through a waist and then become divergent. Ray tracing shows that either positive or negative spherical aberration is introduced in a beam passing through a waist. This aberra- tion is caused by the interaction of the electrons; its sign de- pends on voltage, current and on the angle of initial conver- gence of the beam, For sufficiently high voltages or low currents, waist formation no longer occurs, but the electron rays cross the axis of the beam. With decreasing current density, the transition from waist to crossover is found to occur first for the inner rays of the beam while the outer rays still form a waist. All experimental results are found to be in approximate agreement with theoretical predictions. A.

537.533.331

401. COMPUTATION ON ELECTROSTATIC LENSES. U.Timm. Z. Naturforsch., Vol. 10a, No. 8, 593-602 (Aug., 1955). In German.

Develops a matrix formulation for the determination of lens characteristics. The elements of a lens matrix can be simply related to the usual lens parameters. The properties of lens combinations are then found by matrix multiplication. The method lends itself to numerical computation by approxi- mating the axial potential distribution by a series of linear elements, whose matrix representation is know. A number of examples are discussed in some detail. E.A.Ash

537.533.335

402. THE FIELD DISTRIBUTION IN ASYMMETRICAL MAGNETIC ELECTRON LENSES. G.Liebmann. Proc. Phys. Soc. B , Vol. 68, Pt 9, 679-81 (Sept., 1955).

The field distribution of asymmetrical magnetic electron lenses comprising two polepieces with differing bore radii are plotted. The maximum axial field strength, and hence the refracting power, is shown to increase as the ratio of the bores is made smaller. The asymmetry of the field distribut- ion is shown to be a function of the ratio of the bores only, not depending on their relation to polepiece separation. A.E.I. Research Laboratory

537.533.335

403. THE MAGNETIC PINHOLE ELECTRON LENS. G.Liebmann. Proc. Phys. Soc. B , Vol. 68, Pt 9, 682-5 (Sept., 1955).

An asymmetrical magnetic electron lens having the bore of one polepiece much smaller than that of the other is con- sidered as the combination of one half of a symmetrical lens with a pinhole lens. It is shown that the pinhole lens does not greatly affect the refracting power of the combination, but that, when it is located on the emergent side of the electron beam, it may make a considerable contribution to the spherical aberration. A.E.I. Research Laboratory

537.533.335

404. A UNIFIED REPRESENTATION OF MAGNETIC ELECTRON LENS PROPERTIES. G. Liebmann. Proc. Phys. Soc. B, Vol. 68, Pt 10, 737-45 (Oct., 1955).

It is shown that the focal lengths of all known iron shroud- ed magnetic electron lenses lie between two fairly close limit- curves, if f is measured in the unit S + D for symmetrical or $S + R_1 + R_2$ for asymmetrical lenses of bore radii R_1 and R_2 and gap length S, f being plotted as function of $(NI)^2/V_r$. The lenses of the more usual S/D ratios ($0.5 \leqslant S/D \leqslant 2$) lie very close to the lower limit-curve, i.e. all these lenses can be represented by a single focal-length curve. A similar representation can be given for the other lens constants. A.

537.533.35

405. ON ELECTRON MIRROR MICROSCOPY. L. Mayer. J. appl. Phys., Vol. 26, No. 10, 1228-31 (Oct., 1955).

Deals with a new kind of electron microscopy in which the specimen constitutes an electron mirror. The low veloc- ity of the electrons in front of this mirror-specimen enables pictorial representations of potential distributions on surfaces. A resolving power comparable to that of the light microscope has been obtained. Sample micrographs depicting surface reliefs, potential distributions on surfaces, and the distribut- ion of electrical conductivity are shown. The peculiar kind of image formation is briefly discussed and reference is made to the potentialities of such a research tool for surface physics and metallurgy. A.

537.533.35 : 539.165.08

406. HIGH RESOLUTION AUTOMATIC BETA SPECTRO- METER. R. D. Birkhoff, A. W. Smith, H. H. Hubbell, Jr and J. S. Cheka.

Rev. sci. Instrum., Vol. 26, No. 10, 959-62 (Oct., 1955).

A homogeneous magnetic field beta-spectrometer and its completely automatic control system are described. Momentum resolution is such that a monoenergetic line has a full width at half maximum intensity of 0.22%. The instrument was used to analyse the conversion line spectrum of the 411 keV gamma-ray from Hg^{198}. The data give values of 1 : 0.361 : 0.100 : 0.027 for the conversion ratios K : L : M : N; and 5.9 for $(L_I+L_{II}) : L_{III}$. A.

537.533.35

407. HIGH TRANSMISSION COINCIDENCE SPECTROMETER WITH GOOD RESOLUTION. T.R.Gerholm.
Rev. sci. Instrum., Vol. 26, No. 11, 1069-72 (Nov., 1955).

An electron-electron coincidence spectrometer is described. Magnetic lenses are used for the energy selection in each channel, and the coincidence counting efficiency is increased by using long lens spectrometers. At an effective transmission of 3%, relative half-widths of 1.3% (source diameter 0.2 cm) and 3.1% (source diameter 0.5 cm) were obtained. "Triangular field" focusing, introduced here, gives a favourable high luminosity in spite of small dimensions, distance between source and detector being only 25 cm in each half of the instrument. The focusing properties of this field form are discussed. Anthracene crystals cemented on to Lucite light guides serve as detectors, and it is shown that the light transmission efficiency of the guides can be considerably improved by machining them to a certain profile theoretically corresponding to 100% light collection. In practice efficiencies of 70-60% are obtained for Lucite light guides between 10 cm and 20 cm. The performance of the instrument is illustrated by some results obtained with coincidence measurements on the electron spectrum of Pb^{200}. A.

537.533.74

408. ANOMALOUS ELECTRON SCATTERING FROM IODINE VAPOR. I.L.Karle.
J. chem. Phys., Vol. 23, No. 9, 1739 (Sept., 1955).

Using the sector microphotometer techniques in electron diffraction, the molecular scattering of O_2, Br_2 and I_2 have been measured for 40 kV electrons. A phase shift is encountered with iodine which is not exhibited by the other diatomic molecules. The molecular scattering curve for iodine using 30 kV electrons is normal. G.I.W.Llewelyn

537.533.75

409. TRANSMISSION OF POSITRONS AND ELECTRONS. H.H.Seliger.
Phys. Rev., Vol. 100, No. 4, 1029-37 (Nov. 15, 1955).

The transmissions of monoenergetic beams of positrons and electrons with energies up to 960 keV have been measured in aluminum, brass, silver, tin, lead and gold. The absorber forms the window of a 2π counter whose counting efficiency is better than 99% down to a few hundred electron volts. Particles from a radio-active source, focused into a beam by a 90-degree magnetic analyser impinge perpendicularly on the absorber window of the 2π counter. The total transmission is therefore measured independently of forward angle of emergence or of partial energy loss. Positrons are found to be transmitted to a greater extent than electrons except at low energies in aluminium. These results are correlated with previous backscattering experiments and are in qualitative agreement with theoretical calculations of Rohrlich and Carlson. The shapes of the transmission curves are compared semiquantitatively with predictions of the Spencer theory of electron penetration. A.

537.533.75

410. MEAN FREE PATH FOR DISCRETE ELECTRON ENERGY LOSSES IN METALLIC FOILS. A.W.Blackstock, R.H.Ritchie and R.D.Birkhoff.
Phys. Rev., Vol. 100, No. 4, 1078-83 (Nov. 15, 1955).

The discrete energy losses observed when a beam of electrons passes through a thin foil have been studied as a function of incident energy. Foils of Al, Mg, and Cu ranging in thickness from 14 to 85 microgram/cm^2 have been bombarded with electrons of energies 25 to 115 keV. Losses appear at multiples of 14.9 eV and 10.7 eV respectively for Al and Mg whereas only one loss is found in Cu at 22.6 eV. Mean free paths for the losses lie in the range 25 ± 10 microgram/cm^2, 165 ± 55 microgram/cm^2 and 90 ± 30 microgram/cm^2 for the three metals. The magnitudes of the losses agree with the plasma oscillation theory of Pines and Bohm for Al and Mg if the number of free electrons per atom is chosen about equal to the valence. In addition the mean free path as a function of energy for Al agrees closely with the theoretical curve. A.

537.534

411. EXTRACTED PROTON BEAM OF THE LIVERPOOL 156-INCH CYCLOTRON. A.V.Crewe and K.J.Le Couteur.
Rev. sci. Instrum., Vol. 26, No. 7, 725 (July, 1955).

The efficient extraction of the beam by a magnetic perturbation method is described. J.M.Cassels

537.534

412. PROTON DYNAMICS IN THE LINEAR ACCELERATOR. II. A/G-FOCUSSED SECTION, 10-50 MeV. N.M.King.
Atomic Energy Res. Establ. (Harwell), Mem. T/M118, 16 pp. (1955).

For Pt I, see Abstr. 11131 (1954). The phase and radial motion of protons in the first two tanks of the alternating gradient system has been computed. In contrast to the grid-focused section, the effects of phase oscillation upon the radial orbits are shown to be small here. The result is significant since it demonstrates the sufficiency of considering only the synchronous proton, whose behaviour is readily accessible to an analytic treatment. Acceptance and output "phase-diagrams", analogous to those derived in Pt I, have been obtained. They indicate that the majority of protons expected to be available at 10 MeV will be accepted, and will not make radial excursions greater than 1.0 cm from the axis between 10 and 50 MeV. The output beam at 50 MeV will lie within a radius of 1.0 cm and a divergence of $\pm$ 0.3 degrees. A.

537.534 : 621.319.339

413. VAN DE GRAAFF GENERATOR WITH A LIQUID CHARGE CARRIER. K.Janner, S.Magun and E.Schopper.
Z. angew. Phys., Vol. 7, No. 9, 446-50 (1955). In German.

Examines the possibility of replacing the conventional moving belt by a system of two concentric insulating pipes, carrying a liquid in opposite directions. Transformer oil satisfies the chief requirements of low conductivity, high breakdown strength, and can be charged by the application of a strong inhomogeneous field. Results, showing the current produced as a function of various injector parameters, are presented. It is concluded that for a typical 1 MV generator, a notable reduction in size could be achieved. E.A.Ash (R)

537.534 : 621.319.339 : 621.384.62

414. ELECTRICAL EQUIPMENT FOR A VAN DE GRAAFF GENERATOR. F.Bumiller, V.Meyer, H.H.Staub and H.Winkler.
Z. Naturforsch., Vol. 10a, No. 7, 551-6 (1955). In German.

A description of equipment designed for the University of Zürich 3 MeV. machine. The basic features of the spray system, accelerator tube, equipment in the h.v. electrode and of the ion source are explained. Stabilization is achieved by the use of a variable corona load, controlled by a tetrode circuit. The voltage is measured by a rotating-vane voltmeter, the difference between the rectified output and a reference voltage being applied to the grid of the tetrode. A stability of one part in 10^4 has been realized. E.A.Ash (R)

537.534 : 621.372.413 : 621.384.62

415. DESIGN NOTES ON RESONATORS FOR PROTON

INEAR ACCELERATORS. J.J.Wilkins.
tomic Energy Res. Establ. (Harwell), Rep. GP/R 1613, 5 pp. (1955).

The notes summarize some basic data and methods which ıve been used in designing Berkeley-type r.f. resonators ıitable for accelerating protons to over 100 MeV. Compre-ensive data are given on resonant dimensions, shunt impe-ıances and Q-values, both for single re-entrant cavity resona-ors and for complete Berkeley-type resonators. Transit-me effects, r.f. breakdown limitations and the use of local-ed tuners are among the further topics treated. A.

537.534 : 621.384.611

416. A VARIABLE ENERGY CYCLOTRON. D.E.Caro, .H.Martin and J.L.Rouse.
.ustral. J. Phys., Vol. 8, No. 2, 306-9 (June, 1955).

A cyclotron design is described for accelerating protons h the range 2–12.5 MeV, deuterons in the range 4–6.3 MeV nd alpha particles in the range 8–12.5 MeV. The frequency 'ill vary from 8.5–22 Mc/s, the single dee (with a 3 in. aper-ıre) being tuned partly by variation of length of dee line and 'artly by a variable loading capacitance. The magnet pole ips are carefully rounded at the outer edge to give a maximum urface flux density of less than 1.3 times the central field. aturation effects are then small and reshimming should not e necessary for different energies. J.H.Fremlin

537.534.3

417. A HIGH PRECISION MASS SPECTROMETER FOR .EAD ISOTOPES. H.F.Ehrenberg, J. Geiss and R.Taubert.
:. angew. Phys., Vol. 7, No. 9, 416-23 (1955). In German.

A detailed description of a specialized instrument mainly ntended for the rapid (one sample a day) study of lead and ranium ores. The abundance ratio is determined with an .ccuracy of about 0.1%. About 2 to 20 mg of substance are eeded. Among the special features are: slit widths of .1 mm; 5 kv r.f.-generated accelerating voltage; use of olid samples (PbS). H.Motz

537.534.3

418. HIGH-RESOLUTION MAGNETIC SPECTROMETER. :.Rubin and D.C.Sachs.
tev. sci. Instrum., Vol. 26, No. 11, 1029-34 (Nov., 1955).

A 180° point-focusing magnetic spectrometer was con-:tructed for high resolution analysis of the momentum distri-ıution of protons up to 2 MeV in energy. Mechanical adjust-nents of the poles enabled the field shape to be empirically .djusted for minimum radial aberration in the focal plane. The aperture is 0.0025 steradian, and the momentum resolu-ion is better than 2000. A.

537.534.74

419. PHASE SHIFTS IN p-p SCATTERING. A.Keller.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 930-2 (Oct., 1955).

An effective potential is found which gives the observed p-wave scattering in the 0-18 MeV region. It is concluded :hat the contribution from the tensor force is very small. P.T.Matthews

537.534.74

420. AN APPROXIMATION FOR THE HIGH ORDER PHASE SHIFTS IN THE ELASTIC SCATTERING OF SLOW PROTONS IN THE INERT GASES. C.A.Haywood.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 932-5 (Oct., 1955).

The approximation is based on the expansion of the effective nuclear charge for potential as a series of exponen-tials. The resulting integrals can then be performed analyti-cally. P.T.Matthews

537.534.74

421. POLARIZATION OF PROTONS ELASTICALLY SCAT-TERED FROM NUCLEI. R.M.Sternheimer.
Phys. Rev., Vol. 100, No. 3, 886-90 (Nov. 1, 1955).

The polarization of 130 MeV protons elastically scattered from Be, C, Al, and Fe has been calculated by means of the optical model of the nucleus, including a spin-orbit coupling term. The results are in reasonable agreement with the meas-urements of Dickson, Rose, and Salter. Calculations were also carried out for proton energies of 50 MeV and 90 MeV, in order to explain the rapid decrease of the polarization as the energy is decreased below 130 MeV. By using a central po-tential whose real part decreases with increasing proton energy between 50 MeV and 130 MeV, reasonably good agreement was obtained for the dependence of the polarization on energy for Be and C. A.

537.534.74 : 518.5

422. ON A MECHANICAL ANALYZER FOR PROTON–PROTON TRIPLET PHASE SHIFTS. E.Clementel and C.Villi.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 356-9 (Aug., 1955).

The working principles of a mechanical analyser based on the kinematics underlying the triplet phase shift equations. P.T.Matthews

DISCHARGE TUBES. COUNTERS 537.54

537.542

423. CYCLOTRON ION SOURCE FOR THE PRODUCTION OF N^{3+}. H.L.Reynolds and A.Zucker.
Rev. sci. Instrum., Vol. 26, No. 9, 894 (Sept., 1955).

The source producing triply charged nitrogen ions, now in use in the ORNL 63 in. cyclotron, is described. Internal beam currents of 100 microamp N^{3+} at 24 MeV have been obtained and it is estimated that the source produces at least 1 milliamp of N^{3+}. The source is of the hot-cathode arc dis-charge type with the cathode hood and cylindrical arc chamber machined from a single piece of graphite. The cathode, al-though milled from 1/8 in. tantalum, only lasts about ten hours, but can be replaced in 30 to 40 minutes. The life of the arc chamber is about 40 hours. D.R.Chick

537.542

424. ON THE RESPONSE OF GLASS GEIGER-MULLER COUNTERS WITH EXTERNAL GRAPHITE CATHODES TO INTENSE IRRADIATION WITH GAMMA-RAYS. D.Blanc.
J. Phys. Radium, Vol. 16, No. 8, 681-8 (Aug.-Sept., 1955). In French.

A detailed description, with references, is given of counters with external cathodes. Measurements of sensitive volumes and counting-rate characteristics are described, with special reference to high counting rates (up to about 2.6×10^6 per min). The effect of the tube conductivity is fully treated. J.D.Craggs

537.542

425. OPERATION OF PROPORTIONAL COUNTERS AT HIGH TEMPERATURES. A.Moljk, R.W.P.Drever and S.C.Curran.
Rev. sci. Instrum., Vol. 26, No. 11, 1034-7 (Nov., 1955).

The operation of proportional counters at temperatures up to 900° C has been investigated and it is shown that the factors determining the maximum working temperature are thermal emission of electrons from the cathode, and the con-ductivity of heated insulating materials. Several types of proportional tubes are discussed and the advantages of coun-ters with external cathodes are pointed out. Pulse spectra from quartz and glass counters containing K-capture A^{37} sources indicate satisfactory operation at temperatures of 810° C in the case of quartz and 450° C in the case of glass. A.

537.542 : 778

426. PHOTOGRAPHIC EFFECT OF COUNTER DISCHARGES. K.S.Lion and G.F.Vanderschmidt.
J. Opt. Soc. Amer., Vol. 45, No. 12, 1024-7 (Dec., 1955).

Gas discharges in point or parallel plate counters can produce a blackening effect on photographic emulsion layers inserted in such counters. The discharges are localized to points where ionizing radiation enters the counter. Arrangements of this type can be used for image intensifiers. A description of the operation of such counters and a proposed interpretation as to the physical mechanisms involved are presented. A.

537.542

427. ON THE PURIFICATION OF THE ELECTRON-PULSE IONIZATION CHAMBER. C.Cernigoi and G.Poiani.
Nuovo Cimento (Ser. 10), Vol. 2, No. 3, 677-8 (Sept., 1955).

For a pulse chamber of large dimensions (80 l volume filled with A at 10 atm. pressure) circulation over heated metallic Ca is not practicable for purifying the gas. It is found that passing the gas for some hours over thin copper strips heated electrically to incandescence is satisfactory. D.V.Mabbs

537.542

428. SOME CHARACTERISTICS OF A GRIDDED PARALLEL-PLATE IONIZATION CHAMBER. L. O. Herwig, G. H. Miller and N. G. Utterback.
Rev. sci. Instrum., Vol. 26, No. 10, 929-36 (Oct., 1955).

Studies have been made of effects encountered in the use of a gridded parallel-plate ion chamber for energy measurements. These effects are: gas multiplication about the grid structure, capture of electrons by the grid, and variation of saturation characteristics between various gases and gas mixtures. Curves relating to these are presented for He,Ne, A, Kr, N_2, He+3% CO_2, A+3% CO_2, and A+5% N_2. It is found that the field conditions necessary to prevent electron capture by the grid may be correlated with electron lateral diffusion. Anomalies in connection with the behaviour of argon–carbon dioxide mixtures are pointed out, and several possible explanations for these are discussed. A.

537.542 : 539.165

429. RADIATION COUNTER FOR BETA PARTICLES. D.T.Williams.
Elect. Engng, Vol. 74, No. 7, 595-8 (July, 1955).

A photoconducting crystal of CdS is mounted in a hypodermic needle. Analysis of the counting rate in relation to crystal size, radioactive atom concentration, mean life and energy of beta-particles is given. G.F.J.Garlick

537.542

430. PROBLEMS OF LARGE-AREA SCINTILLATION COUNTERS. F.X.Roser.
Acta phys. Austriaca, Vol. 9, No. 3-4, 297-323 (1955). In German.

A review is given of the factors affecting the performance of large-area counters using liquid scintillators, such as: liquid phosphor characteristics, light collection difficulties, photocathode non-uniformity and electron multiplication processes. A list of over 100 references is provided. G.F.J.Garlick

537.542

431. ENERGY MEASUREMENTS WITH A PLASTIC SCINTILLATOR. F.Boreli and B.Grimeland.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 336-9 (Aug., 1955).

537.542

432. SCINTILLATION COUNTER FOR DETECTION OF X-RAYS. J.T.Nelson and R.T.Ellickson.
J. Opt. Soc. Amer., Vol. 45, No. 11, 984-6 (Nov., 1955).

A scintillation counter using NaI(Tl) is described. The sensitivity is such that the yield of photoelectrons is about 3.5 per 1000 eV X-ray energy. The response is linear over a range in intensity of 5×10^5. A.

537.542

433. TRIPLE COINCIDENCE MIXER FOR FAST PULSES. H. Glättli, E. Loepfe and P. Stoll.
Helv. phys. Acta, Vol. 28, No. 4, 364-6 (1955). In German.

A brief description of a circuit for counting triple coincidences, developed for experiments using the $B^{11}(p,\alpha)2\alpha$ reaction. E. A. Ash

537.542

434. FAST COUNTING SYSTEM FOR HIGH-ENERGY PARTICLE MEASUREMENTS. R.Madey.
Rev. sci. Instrum., Vol. 26, No. 10, 971-7 (Oct., 1955).

A fast coincidence counting system for high-energy particle measurements combines a scintillation counter pulse-shaping circuit and a crystal diode coincidence circuit. The system is simple and reliable. Both the resolution time of the system and the double pulse separation time of the individual counters can be as short as three millimicroseconds, with essentially 100% detection efficiency. A.

537.542 : 621.317.79

435. NEW CIRCUIT FOR THE MEASUREMENT OF VERY SHORT DELAYS. F.Lepri, L.Mezzetti and G.Stoppini.
Rev. sci. Instrum., Vol. 26, No. 10, 936-41 (Oct., 1955).

A circuit for the measurement of time intervals down to 10^{-10} sec is described. It works on the principle of transforming the delay τ to be measured into a flat-topped signal whose amplitude is proportional to τ, and whose length is independent of τ and controllable at will within wide limits (up to about 100 μ sec). The precision and stability of the circuit are discussed. A.

537.542

436. LIQUID HYDROGEN BUBBLE CHAMBERS. D. Parmentier, Jr and A. J. Schwemin.
Rev. sci. Instrum., Vol. 26, No. 10, 954-8 (Oct., 1955).

Chambers $2\frac{1}{2}$ inches and 4 inches in diameter have been constructed of brass with pyrex ports and sealed with lead-wire gaskets. Metal walls and a copper heat-leak eliminate the need for a surrounding pressurized bath. The required fast-pulsing techniques and use of a heat regenerator are described in detail. Schematic diagrams show the chambers, pressure- and temperature-monitoring devices, and illumination method, and photographs of typical tracks and events are included. A.

537.542

437. HIGH-PRESSURE DIFFUSION CLOUD-CHAMBER SYSTEM. R.A.Schluter and S.C.Wright.
Rev. sci. Instrum., Vol. 26, No. 11, 1053-7 (Nov., 1955).

The high-pressure diffusion cloud-chamber system in use at the University of Chicago is described. The chamber is characterized by: (1) 30 atm of hydrogen operating pressure, (2) a sensitive volume 16 inches in diameter and $2\frac{1}{2}$ to 3 inches deep, (3) a quite uniform and accurately known magnetic field of 12 600 gauss, and (4) unit assembly in which the magnet pole is an integral part of the chamber. Pictures are analysed by a three-dimensional reprojection system designed to eliminate optical distortion. Devices for rapid and accurate measurement of several different types of events are described. A.

537.542

438. MEASUREMENT OF CURVATURE, LENGTH AND SPATIAL DIRECTION OF CLOUD-CHAMBER TRACKS. J.B.Dicks and J.I.Hopkins.
Rev. sci. Instrum., Vol. 26, No. 11, 1061-4 (Nov., 1955).

This method of obtaining information from stereoptic pictures of events in cloud chambers holds several advantages

er methods currently in use. It permits the measurement tracks which make large angles with the plane of the chamr. The equipment required is simple to construct. Errors volved in the measurements are small. About ten minutes e required to measure the energy and angular direction of a lical track. A disadvantage of this method is that the operar must have some experience in order to work effectively.
A.

537.543

39. DEMONSTRATION TRIODES. W. A. Hilton and . T. Clayton.
mer. J. Phys., Vol. 23, No. 6, 384 (Sept., 1955).

IONIZATION. THERMIONICS 537.56/.58

537.56

40. THRESHOLD LAW FOR MULTIPLE IONIZATION. .H.Wannier.
hys. Rev., Vol. 100, No. 4, 1180 (Nov. 15, 1955).
On the basis of evidence from single ionization, an approximate threshold law for multiple ionization is derived.
A.

537.564

41. FORMATION OF NEGATIVE OXYGEN IONS IN THE OLLISION OF POSITIVE OXYGEN IONS WITH GAS MOLEULES. Ya.M.Fogel' and L.I.Krupnik.
h. éksper. teor. Fiz., Vol. 29, No. 2(8) 209-20 (1955). In ussian.
Negative ions formed in the bombardment of hydrogen, xygen and nitrogen are separated off by a mass spectrometer. Measurements of the effective cross-section with incident tomic ions O_1^+ are carried out in the range 15—41 keV; ith incident molecular ions O_2^+ at 18 keV. Measurements n the process $O_1^+ \rightarrow O_1^{++}$ and $O_2^+ \rightarrow O_1^+ + O_1$ are also made.
G.E.Brown

537.581

42. VELOCITY ANALYSIS OF THERMIONIC EMISSION ROM SINGLE-CRYSTAL TUNGSTEN. G.F.Smith.
hys. Rev., Vol. 100, No. 4, 1115-16 (Nov. 15, 1955).
Hutson has observed a non-Maxwellian distribution of hermionic emission from various crystallographic directons of a tungsten single crystal. It is suggested that the rue distribution is Maxwellian, and that the observed istribution is due to an analyser resolution of 0.24 V. actors which might affect resolution are discussed, and utson's numerical results are recalculated on the basis of his explanation.
A.

COSMIC RAYS 537.591

537.591.1

43. THE NEW UNSTABLE PARTICLES IN THE COSMIC ADIATION. M.Deutschmann.
aturwissenschaften, Vol. 42, No. 18, 499-506 (1955). In erman.
A fairly comprehensive review of the unstable particles ound by the nuclear emulsion and cloud chamber techniques n cosmic radiation. Divided into three sections: An introuction which includes references to L-mesons; K-mesons; nd a section dealing with hyperons. The properties of the articles are described and current theories (Pisa Conference 955) about their existence and modes of decay are given.
D.J.Prowse

537.591.1

444. METEOROLOGICAL EFFECTS ON A COSMIC RAY COUNTER TRAY. R. Akpinar.
Rev. Fac. Sci. Univ. Istanbul C, Vol. 20, No. 1, 53-61 (Jan., 1955).
Background recordings of an unshielded G. M. tray during 13 months (February 1953 - March 1954) in Istanbul are analysed to pick out the meteorological factors influencing the recorded intensity. Several increases of this were observed, which were all attributable to atmospheric precipitations. It is found that four rules govern all the observed variations. These rules may be interpreted in terms of general behaviour of the radioactive contents of the atmosphere (natural and fission produced), the effects of precipitations, and local factors.
A.

537.591.1

445. THE ENERGY BALANCE OF COSMIC RAYS. H. Komori.
Progr. theor. Phys., Vol. 13, No. 2, 205-16 (Feb., 1955).
The energy dissipated by the vertical flux of cosmic rays at three geomagnetic latitudes ($\lambda = 56^\circ$, 28° and 3°) is studied. Comparing this result with the incident energy obtained from intensity measurements at the free atmosphere, a difference of about 30% is found, which is nearly independent of the latitude. It is shown that the difference may be attributed to the low-energy particles which cause the albedo effect near the top of the atmosphere. On the other hand, an alternative interpretation that the difference could be imputed to heavy unstable particles, especially K-particles, may arise. This possibility is examined and it is found that the whole difference cannot be ascribed to K-particles. Taking account of the low-energy particles, it is concluded that the energy balance is consistent with present knowledge. The energy ratios of neutral to charged π-mesons are found to be 0.57 ± 0.07, 0.44 ± 0.07 and 0.36 ± 0.08 at $\lambda = 56^\circ$, 28° and 3° respectively.
A.

537.591.1

446. THE POSITIVE—NEGATIVE DIFFERENCE OF COSMIC-RAY MUONS. Y.Yeivin.
Nuovo Cimento (Ser. 10), Vol. 2, No. 3, 658-60 (Sept., 1955).
It is suggested that the positive—negative muon difference is a quantity which directly related to the first-generation collisions of the primary protons. A simple collision model is used to derive the positive excess. In this model the primary-air nucleus collisions are treated as "composite" collisions, the pion multiplicity rises as a power of the collision energy and all pions appear in the c.m. system with the same energy. Comparing the curves derived for the positive excess v. muon energy with the experimental results, a value of 1.98 is obtained for "s" in the primary proton differential spectrum $n(E) \propto E^{-S}$. If the primary spectrum is taken to be $n(E) \propto (E + B)^{-\gamma}$, as is generally accepted, a variable "s" which increases with primary energy would be obtained. The experimental results would fit better with a greater "s" above 10 GeV. Further work is in progress taking into account the effect of K-meson production at high energies.
D.J.Prowse

537.591.1

447. ON THE POSITIVE TEMPERATURE EFFECT IN THE COSMIC RADIATION AND THE μ—e DECAY. H.Trefall.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 893-904 (Oct., 1955).
It is shown that the positive partial correlation which exists between the meson intensity at sea level and the stratospheric temperature can be interpreted as being due to the μ—e decay. Two "second-order" effects of the μ—e decay contribute to the positive temperature effect which is observed at sea level. One is due to the fact that neither of the standard pressure levels (the 100 mb and 50 mb levels) which have been used as reference levels in the analysis of experimental data is a sufficiently good approximation to the mean level of meson production. The other is due to the fact that the survival probability of a μ-meson depends on the way in which

its energy loss is distributed over the distance which the meson has to traverse. The theoretically predicted values of the positive temperature effect associated with the μ–e decay are in reasonable agreement with the available experimental results. The observed dependence of the effect on the choice of reference level is also explained. A.

537.591.1

448. COSMIC-RAY ELECTRONS NEAR SEA LEVEL AND AT MOUNTAIN ALTITUDES. P.R.Barker.
Phys. Rev., Vol. 100, No. 3, 860-9 (Nov. 1, 1955).

A cloud chamber containing aluminium and lead plates has been used to study the intensities and energies of cosmic-ray electrons as a function of altitude and zenith angle. The energy distribution is found to be approximately independent of altitude and zenith angle. The decrease of electron intensity with zenith angle is found to be much less than has been reported by investigators using counter telescopes. The increase of the vertical intensity with altitude is found to be slightly smaller than previously reported. The numbers of electrons resulting from decay and collision processes of μ-mesons have been calculated and subtracted from the observed numbers. The residual electrons have an exponential altitude-dependence with an absorption length of 135 ± 15 g.cm^{-2}, and a zenith-angle dependence which is much less steep than would be expected if they preserved the directions of the primary particles from which they originate. A.

537.591.15

449. THE "EQUILIBRIUM" ENERGY SPECTRUM OF CASCADE PHOTONS. P.S.Isaev.
Zh. éksper. teor. Fiz., Vol. 28, No. 3, 374-6 (1955). In Russian.

The effect on this of a correction to the formula for the contribution of the Compton effect is made according to Abstr. 8394 (1954) for C, Al, Fe, Cu and Pb. For Pb the resulting correction to the spectrum reaches 74.5% at one energy. W.J.Swiatecki

537.591.15

450. ANGULAR DISTRIBUTION IN ELECTRON–PHOTON SHOWERS WITHOUT THE LANDAU APPROXIMATION. B.A.Chartres and H.Messel.
Phys. Rev., Vol. 99, No. 5, 1604-5 (Sept. 1, 1955).

The Tamm–Belenky approximate model yields an analytic expression for the angular distribution, given any scattering cross-section. This is evaluated for a cascade in air and compared with results from the Landau approximation.
G.E.Brown

537.591.15

451. HIGH-ENERGY ELECTROMAGNETIC PHENOMENA IN COSMIC RADIATION. M.Koshiba and M.F.Kaplon.
Phys. Rev., Vol. 100, No. 1, 327-39 (Oct. 1, 1955).

Isolated high-energy electron showers in photographic emulsion have been investigated and have yielded the following conclusions: (1) Out of 16 cases of isolated electron showers observed to originate from single electron pairs of energy greater than 1 BeV, two cases have been found to be anomalous in the sense that they seem to have been initiated by more than 2 photons; one of the two has been analysed in detail. (2) The discrepancy between the experimental observations and theoretical predictions on the trident process found in a previous work has been obtained again with the additional experimental data of this experiment. A.

537.591.15

452. ANOMALIES IN THE COSMIC-RAY SHOWER CURVES FOR LEAD. R.M.Chaudhri, Abdul Qayum and Afzal Farooqi.
Nature (London), Vol. 176, 876 (Nov. 5, 1955).

The intensity of cosmic-ray showers in lead has been determined as a function of thickness by three and four-fold coincidences. Three maxima were found at 1–2 cm, 14–15 cm, and 24–25 cm. The first is well established but the second and third have been a matter of controversy. These maxima occurred in all experiments but there was an indication that the second and third were situated at slightly greater thicknesses with the 4-fold than with the 3-fold coincidences.
D.J.Prowse

537.591.2

453. THE ENERGY SPECTRUM OF THE PRIMARY COSMIC RADIATION. U. Haber-Schaim.
Nuovo Cimento Suppl. (Ser. 10), Vol. 2, No. 1, 336-8 (1955).

This has been investigated in the energy band 60-1000 GeV. Two methods have generally been employed: one, deducing the primary spectrum from the range spectrum of energetic muons underground; the other, more direct, is based on the analysis of stars produced in photographic emulsions at high altitudes. Using this latter method, the values obtained for E, the energy of the primary, are fitted to an E^{-s} curve, and values for s have been determined and tabulated from 65 stars of E greater than 60 GeV.
E.W.Kellermann

537.591.5

454. STUDY OF THE ANISOTROPY OF COSMIC RAYS WITH NARROW ANGLE TELESCOPES. V.Sarabhai, N.W.Nerurkar and P.D.Bhavsar.
Proc. Indian Acad. Sci. A, Vol. 41, No. 6, 245-52 (June, 1955).

Using narrow-angle telescopes significant daily variations in cosmic-ray intensities have been observed. The variations and their dependence on the angular width of the telescope are discussed. A.J.Egginton

537.591.5

455. ON DIURNAL VARIATION IN COSMIC-RAY INTENSITY AT OTTAWA. S.D.Chatterjee and J.N.Bloom.
Canad. J. Phys., Vol. 33, No. 10, 577-87 (Oct., 1955).

Cosmic-ray data from a high-pressure integrating ionization chamber for 129 complete days during September 1950 to July 1951 are subjected to rigorous statistical analysis. The barometric coefficient is –0.19% per mm of Hg for the period covered by this analysis. The results also indicate a physically significant 24 hr wave in cosmic-ray intensity, with an amplitude of 0.12% of the total intensity, having its maximum at about 10.40 a.m. local mean time. The existence of the semidiurnal wave, however, is not physically significant. A.

537.591.5

456. VARIATION OF THE POSITION OF THE COSMIC-RAY NEUTRON INTENSITY MAXIMUM WITH GEOMAGNETIC LATITUDE. R.K.Soberman, A.Beiser and S.A.Korff.
Phys. Rev., Vol. 100, No. 3, 859-60 (Nov. 1, 1955).

It has been experimentally demonstrated that there exists a maximum in the cosmic-ray neutron intensity when plotted as a function of altitude or pressure. The position of this maximum at various geomagnetic latitudes in the northern hemisphere has been measured by experiments which used balloon-borne unshielded BF_3 counters with various enrichments of the B^{10} isotope. It has been found that the position of the maximum varies approximately parabolically when plotted as a function of geomagnetic latitude. The range of variation is from about 120 millibars at the equator to about 70 millibars at the north geomagnetic pole. The experimental results are compared with theory. A.

MAGNETISM 538

538.114

457. A THEORY OF ANTIFERROMAGNETISM. II. T.Oguchi.

l'ogr. theor. Phys., Vol. 13, No. 2, 148-59 (Feb., 1955).
For Pt I, see Abstr. 3647 (1954). General theories of ferromagnetism and antiferromagnetism based on the Heisenberg model, which are extensions of the Weiss theory, are presented. The approximation of these theories is not as good as that of the author's previous theories, but the main object of this paper is to develop simple and tractable theories which can include short-range order effects. The perpendicular susceptibility of an antiferromagnet below the Néel point is obtained, and is almost independent of temperature. The large residual entropy above the Néel point of $CuCl_2 2H_2O$ can be explained by application of the present theory. A.

538.114

458. BLOCH WALL ENERGY OF THIN FILMS. L. Néel.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 533-6 (Aug. 8, 1955). In French.
Shows that the wall energy increases as the film width decreases, reaches a maximum (about 10 γ_0 at a width of about 100 A for iron) and finally decreases to the normal value γ_0 for a bulk metal as the width tends to zero. E. P. Wohlfarth

538.114

459. RESULTS AND PROBLEMS OF THE QUANTITATIVE THEORY OF COERCIVITY. R. Brenner.
Z. angew. Phys., Vol. 7, No. 10, 499-507 (Oct., 1955). In German.
A critical review of the Kersten and Néel treatments.
E. P. Wohlfarth

538.114

460. FERROMAGNETIC AND ANTIFERROMAGNETIC CURIE TEMPERATURES. H.A.Brown and J.M.Luttinger.
Phys. Rev., Vol. 100, No. 2, 685-92 (Oct. 15, 1955)
The methods of calculating Curie temperatures used by Opechowski and Weiss are extended to higher spin values. Using the former, Curie temperatures are found for the face-centred, body-centred, and simple cubic and the hexagonal and quadratic layer lattices for spin $\frac{1}{2}$ to 3. Weiss' method is applied to body-centred and simple cubics for spin $\frac{1}{2}$ to 2 and to the quadratic layer lattice for spin $\frac{1}{2}$ to 1. Numerical results show good agreement between the two methods for three-dimensional ferromagnetic lattices. However, the Opechowski method fails to locate the antiferromagnetic transition and predicts a transition for the two-dimensional lattices while the Weiss method does not. A classical-spin approximation is investigated and is found to give Curie temperatures within a few per cent of the quantum-mechanical results for spin 1 or greater. A.

538.114

461. THE FLUCTUATING FIELD MODEL OF FERROMAGNETISM WITH PARTICULAR REFERENCE TO NICKEL.
F.D.Stacey.
Canad. J. Phys., Vol. 33, No. 11, 661-7 (Nov., 1955).
Following Néel's calculations of fluctuations in intermolecular field, a model is suggested in which there is a mutual repulsion of elementary magnets, so that spontaneous magnetization is affected by a process of ordering of the magnets on the lattice sites as well as the ordering in orientation. Specific heat considerations indicate that, if it occurs, the second disordering process is also complete at the Curie point. To explain the observed spontaneous magnetization of nickel it is necessary to assume coupled electron spins and appreciable next-nearest-neighbour exchange interactions. A.

538.22

462. PRINCIPAL MAGNETIC SUSCEPTIBILITIES OF A CRYSTAL OF DIALOGITE ($MnCO_3$). H. Bizette and B. Tsaï.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 369-71 (July 25, 1955). In French.
Measurements between 300°K and liquid helium temperature indicate that the magnetic anisotropy ($\chi_{\parallel} - \chi_{\perp}$) changes sign at a temperature which depends upon the strength of the applied field. A. E. De Barr

538.221

463. THE MINIMUM SIZE OF WEISS—HEISENBERG DOMAINS OF COBALT. A.Knappwost.
Naturwissenschaften, Vol. 42, No. 16, 459 (1955). In German.
From measurements of the susceptibility of a supersaturated Cu—Co alloy, containing 0.715% Co, during the process of precipitation of pure Co in dispersed form, the minimum domain size is found to be 16 A, assuming the applicability of the Langevin formula. E.P.Wohlfarth

538.221

464. MAGNETIC FERRITES WITH HYSTERESIS LOOPS CHARACTERISTIC OF PERMINVARS. M.Kornetzki, J.Brackmann and J.Frey.
Naturwissenschaften, Vol. 42, No. 17, 482 (1955). In German.
"Wasp-waisted" loops were observed in Ni- and Ni-Zn ferrites containing small additions of MnO and CoO. The character of the loops is altered by cooling in a magnetic field, the loops becoming anisotropic. E.P.Wohlfarth

538.221

465. IRREVERSIBLE MAGNETIC AFTER-EFFECT AND ITS INFLUENCE ON THE COURSE OF THE MAGNETIZATION CURVE. O. Yamada.
Z. Phys., Vol. 142, No. 2, 225-40 (1955). In German.
Reports results on specimens of Alnico of the change of magnetization with time. The results are discussed in terms of Néel's treatment, the constant Q being found to equal about 10. E.P.Wohlfarth

538.221

466. RELAXATION PHENOMENA IN FERRITES.
A. M. Clogston.
Bell Syst. tech. J., Vol. 34, No. 4, 739-60 (July, 1955).
Galt (Abstr. 5797/1954) suggested a mechanism for the losses observed in ferromagnetic resonance and domain wall motion in single crystals of nickel ferrite containing small amounts of divalent iron substituted for divalent nickel. Each such substitution provides one electron able to move between the various octahedral sites in the crystal. Galt's suggestion is that the losses arise from a relaxation associated with the motion of these electrons. This paper develops a theory of this mechanism based on a thermodynamic model. Expressions are found for the velocity of domain wall motion, for the line width in ferromagnetic resonance and for the displacement of the field for resonance. A.

538.221

467. ON THE THEORY OF THE COERCIVE FORCE OF THE BARIUM FERRITE PERMANENT MAGNET MATERIAL MANIPERM. H.G.Müller.
Dtsch. Elektrotech., Vol. 9, No. 8, 286-90 (Aug., 1955). In German.
The factors contributing to the coercive force of magnetic materials and of Maniperm particularly, are discussed and it is concluded that the coercive force of this material is due primarily to the magnetocrystalline anisotropy of its particles.
A.E.De Barr

538.221

468. THE COERCIVE FORCE OF NICKEL POWDER AT LOW TEMPERATURES. L.Weil.
C.R. Acad. Sci. (Paris), Vol. 241, No. 5, 470-2 (Aug. 1, 1955). In French.
The coercive force was found to depend on temperature, the details of the applied heat treatment with or without the application of a magnetic field, the previous thermal history and the time. E.P.Wohlfarth

538.221

469. MAGNETIC PROPERTIES OF NEUTRAL CRYSTALLINE ANHYDROUS NICKEL CARBONATE $NiCO_3$. H. Bizette and B. Tsaï.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 546-8 (Aug. 8, 1955). In French.

This substance is shown to be ferromagnetic below about 40° K, exhibiting magnetically hard properties. Between 60° and 290° K the susceptibility obeys the Curie–Weiss law, with $p_B = 3.2$. E. P. Wohlfarth

538.221

470. FERROMAGNETIC RESONANCE OF GADOLINIUM FERRITE AS DEPENDENT ON TEMPERATURE, AT 9000 Mc/s. J. Pauleve.
C.R. Acad. Sci. (Paris), Vol. 241, No. 8, 548-50 (Aug. 8, 1955). In French.

The resonance field was measured between −200° and +270° C and found to reach low values in the neighbourhood of the compensation temperature, 33° C. E. P. Wohlfarth

538.221

471. ON THE MEASUREMENT OF THE MAGNETIC PERMEABILITY OF METALS BY MEANS OF A CAVITY RESONATOR AND THE PERMEABILITY OF IRON IN THE REGION OF FERROMAGNETIC RESONANCE. I. K.H.Reich.
Frequenz, Vol. 9, No. 9, 299-305 (Sept., 1955). In German.

An account of the results of theoretical and experimental investigations of the permeability of iron at frequencies up to 100 Gc/s. The subject is introduced historically, and then there is a review of the theory of magnetic permeability, particularly in the region of ferromagnetic resonance.
A.E.De Barr

538.221

472. THE BEHAVIOUR OF FERRITE CORES WITH RECTANGULAR MAGNETIZATION LOOPS IN AN INHOMOGENEOUS MAGNETIC FIELD AND ON CUTTING. M.Kornetzki and H.Burger.
Frequenz, Vol. 9, No. 9, 306-9 (Sept., 1955). In German.

The ratio of the induction at a field strength of $-\frac{1}{2}$ (peak value) to that at the peak is taken as a measure of the rectangular nature of the loop. The effects on this ratio of: (a) the ratio of internal to external diameter, (b) a uniformly varying cross-sectional area, (c) two diametrically opposite air gaps of varying width in ring cores of MgMn ferrite are reported. A.E.De Barr

538.221

473. FIRST-ORDER MAGNETIC ANISOTROPY CONSTANTS OF FERRITES. J.B.Birks.
Phys. Rev., Vol. 99, No. 6, 1821 (Sept. 15, 1955).

Certain sources of error in attempting to derive the first-order anisotropy constants of ferrites from magnetostatic data are pointed out. High-frequency observations, particularly of the natural spin resonance frequency, are preferable. A.

538.221

474. ON THE ORIGIN OF MAGNETIC ANISOTROPY INDUCED BY MAGNETIC ANNEALING. S.Chikazumi and T.Oomura.
J. Phys. Soc. Japan, Vol. 10, No. 10, 842-8 (Oct., 1955).

The magnitude of this anisotropy was measured as a function of composition for iron–nickel alloys. It is concluded that it is proportional neither to the magnetostriction nor to the saturation magnetization. The origin of this anisotropy, therefore, can be explained neither by the theory of "strain of directional order" nor by the theory of "elongated order phase". The result can be consistently explained by the dipole–dipole interaction in directionally ordered arrangement of atoms. The result is compared with Néel's formulae. A.

538.221 : 536.413

475. THERMAL EXPANSION STUDY OF SAMARIUM FERRITE AND THE MAGNETIC TRANSITIONS OF THE RARE-EARTH FERRITES. G.Guiot-Guillain and X.Wache.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 550-2 (Aug. 8, 1955). In French.

The expansion coefficient/temperature curve exhibits a change of slope at about 400° C, one of the two magnetic transition temperatures, but not at the other, 300° C.
E. P. Wohlfarth

538.221 : 539.234

476. MAGNETIC DOMAINS IN THIN FILMS OF IRON-NICKEL. C.A.Fowler, Jr and E.M.Fryer.
Phys. Rev., Vol. 100, No. 2, 746-7 (Oct. 15, 1955).

Reports observations using the Kerr effect on an evaporated 80% Ni–Fe film of thickness 5×10^3 A. The pattern consists of a number of antiparallel surface domains several mm wide and separated near some film edges by dagger-like domains of varying lengths. Application of weak fields causes domain wall movement. Surface domains are absent in thicker films ($1–2 \times 10^4$ A). E.P.Wohlfarth

538.222

477. ANTIFERROMAGNETISM OF MANGANESE–COPPER AND MANGANESE–GOLD ALLOYS. A.Kussmann and E.Raub.
Naturwissenschaften, Vol. 42, No. 14, 411 (1955). In German.

Susceptibility maxima were observed at about −125° C for Mn–Cu alloys with Mn concentrations between 30 and 65%, and at about 0° C for $MnAu_2$ in a field of strength 1.38×10^4 oersted and at higher temperatures in lower fields. For results of measurements on $MnAu_3$, see Abstr. 7187/1955.
E.P.Wohlfarth

538.222 : 536.63

478. MAGNETIC AND THERMAL PROPERTIES OF UI_3 AT LIQUID HELIUM TEMPERATURES. L.D.Roberts and R.B.Murray.
Phys. Rev., Vol. 100, No. 2, 650-4 (Oct. 15, 1955).

Previous measurements of the magnetic susceptibility of UI_3 revealed a susceptibility maximum near 3.2° K of antiferromagnetic character, and a second susceptibility maximum at 1.5° K which is strongly depressed by an applied magnetic field of only 5 to 10 oersteds. The specific heat of UI_3 has now been measured from 1.2° to 4.2° K. These measurements show a λ-type anomaly of magnitude 10 joules/mole.deg at 2.61° K which is interpreted as arising from the antiferromagnetic transition. The behaviour of the entropy and specific heat curves indicates an extensive short-range order above the antiferromagnetic transition point. The lower temperature susceptibility anomaly is tentatively interpreted as a manifestation of the growth of long-range antiferromagnetic order. A.

538.222

479. THE EFFECT OF EXCHANGE IN THE PARAMAGNETIC RESONANCE OF CHARCOALS. J.Uebersfeld.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 371-3 (July 25, 1955). In French.

In a sugar charcoal the paramagnetic electron resonance line width increases from 2 to 7 gauss as the free radical concentration is reduced from 1×10^{20} to 5×10^{19} by removal of O_2 by pumping. D.H.Whiffen

538.222

480. CORRELATION BETWEEN PARAMAGNETIC ABSORPTION OF POWDERS AND SINGLE CRYSTALS OF $CuSO_4.5H_2O$. M.B.V. Palma, M.U. Palma, D. Palumbo and M. Santangelo.
Ricerca sci., Vol. 25, No. 8, 2364-7 (Aug., 1955). In Italian.

A variation has been established of the g and the semi-

idths of the paramagnetic resonance absorption line of $uSO_4 . 5H_2O$ crystals caused by passage from 300°K to 77°K. he results obtained and their interpretation are given. They ermit an explanation of results previously obtained with the ame salt in powder form. A.

538.222

481. NUCLEAR HYPERFINE STRUCTURE IN THE PARAMAGNETIC RESONANCE ABSORPTION OF TRIARYLAMINIUM PERCHLORATES. O.R.Gilliam, R.I.Walter and V.W.Cohen.
. chem. Phys., Vol. 23, No. 8, 1540 (Aug., 1955).

The electron resonance spectra of $(G\text{-}C_6H_4)_3N^+ClO_4^-$, with G = p-$CH_3O$-, p-$C_6H_5$- and p-$CH_3OCO$-, in dilute solution show yperfine structure of three peaks with 10 ± 1 gauss separation. his is due to coupling with the N^{14} spin and indicates that the lectron is not in a pure p orbital but some s character must e present. This would be expected if the ion were pyramidal.

D.H.Whiffen

538.222

482. PARAMAGNETIC RESONANCE ABSORPTION OF FERRIHAEMOGLOBIN AND FERRIMYOGLOBIN DERIVATIVES. J. E. Bennett, D. J. E. Ingram, P. George and J. S. Griffith.
Nature (London), Vol. 176, 394 (Aug. 27, 1955).

Paramagnetic electron resonance experiments from 3.2 o 0.6 cm on polycrystalline acidic ferrihaemoglobin and its luoride complex indicate g = 5.90 ± 0.05, and single crystal work indicates this is $g_\perp$ (i.e. in the plane of the Haem). The g value is inconsistent with ionic binding to Fe^{+++} in a S state.

D. H. Whiffen

538.222

483. PARAMAGNETIC RESONANCE OF NaCl CRYSTALS CONTAINING ADDITIONS OF MANGANESE IMPURITIES. K. Oshima, H. Abe, H. Nagano and M. Nagusa.
J. chem. Phys., Vol. 23, No. 9, 1721-2 (Sept., 1955).

NaCl slowly cooled from a melt with Mn impurities (1) gave an electron resonance with half-width 39 ± 5 Oe, whereas quenched material or crystals from solution (2) gave 222 ± 15 Oe. At 300° to 500° C type (1) reverts to (2) at a rate governed by an activation energy of 27 kcal/mole.

D.H.Whiffen

538.222

484. PARAMAGNETIC RESONANCE OF X-IRRADIATED TEFLON. EFFECTS OF ABSORBED OXYGEN. W.B.Ard, H.Shields and W.Gordy.
J. chem. Phys., Vol. 23, No. 9, 1727-8 (Sept., 1955).

X-rayed Teflon gave a pattern of eight symmetrical peaks in a paramagnetic electron resonance experiment, and this is taken to indicate that the odd electron covers 7 F atoms. The pattern is replaced by a single peak on ageing in air or O_2 but not in N_2 or vacuum. At 23 000 Mc/s the single peak is split to a triplet by crystal field effects.

D.H.Whiffen

538.222

485. PARAMAGNETIC RESONANCE ABSORPTION IN SINGLE CRYSTALS OF DIPHENYLPICRYLHYDRAZYL AT LOW TEMPERATURES. L.S.Singer and C.Kikuchi.
J. chem. Phys., Vol. 23, No. 9, 1738-9 (Sept., 1955).

Paramagnetic electron resonance experiments on a single crystal of diphenylpicrylhydrazyl show that the line width, g factor, anisotropy, and principal magnetic directions all change markedly near 15°K. D.H.Whiffen

538.222

486. PARAMAGNETIC RESONANCE AT LOW FIELDS. S. Becker.
Phys. Rev., Vol. 99, No. 6, 1681-3 (Sept. 15, 1955).

Paramagnetic resonance in 2,2-diphenyl-1-picrylhydrazyl and Wurster's Blue at very low values of applied magnetic fields has been investigated. The disappearance of the maximum of the absorption curve below frequencies of 1.3 Mc/s has been substantiated. A twin-T resonance spectrometer is described briefly. Line broadening with dilution of diphenylpicrylhydrazyl in benzene was investigated at 35 gauss and the second and fourth moments of the absorption curves calculated. These data show that the fourth moment increases more than the second moment as dilution is increased. A.

538.222 : 539.13

487. PARAMAGNETIC ABSORPTION OF POTASSIUM COMPLEXES OF AROMATIC COMPOUNDS. R. C. Pastor and J. Turkevich.
J. chem. Phys., Vol. 23, No. 9, 1731 (Sept., 1955).

The width ΔH of the paramagnetic electron resonance of solid adducts of K with aromatic hydrocarbons is studied and an empirical relationship, $\Delta E = 231 - 84(\Delta H/\Delta H_0)$, found, in which ΔE is the resonance energy in kcal/mole and ΔH_0 the width of the diphenyl picryl hydrazyl standard.

D. H. Whiffen

538.224

488. MAGNETIC SUSCEPTIBILITIES OF MONOCRYSTALLINE AND LIQUID GALLIUM. A. Marchand.
C.R. Acad. Sci. (Paris), Vol. 241, No. 5, 468-70 (Aug. 1, 1955). In French.

Reports results of measurements of the principal diamagnetic susceptibilities between 80° and 290°K. Liquid Ga was found to be slightly paramagnetic at 310°K.

E.P.Wohlfarth

538.224

489. MAGNETIC SUSCEPTIBILITY OF GERMANIUM. D.K. Stevens, J.W. Cleland, J.H. Crawford, Jr and H.C. Schweinler.
Phys. Rev., Vol. 100, No. 4, 1084-93 (Nov. 15, 1955).

The magnetic susceptibility of a variety of Ge specimens has been measured as a function of temperature over the range from 70 to 300°K. The susceptibility of high-purity specimens shows an unexpected temperature dependence: a decreasing diamagnetism with increasing temperature. By subtracting the susceptibility of high-purity Ge at each temperature from that of impure material, the charge carrier susceptibility has been obtained for a number of n- and p-type specimens. The effective mass of electrons obtained from susceptibility measurements on n-type Ge is in agreement with values yielded by cyclotron resonance. Analysis of the range of transition from classical to Fermi–Dirac statistics suggests that the energy surfaces of the conduction band can be described by four rather than eight ellipsoids of revolution in k-space. In p-type Ge the agreement with cyclotron resonance results is not nearly so good in that a larger hole effective mass is required by the susceptibility data. Measurements have been made on one n-type specimen bombarded with fast neutrons. After exposures sufficient to produce essentially intrinsic behaviour, there was no trace of the paramagnetic component expected from unpaired spins of trapped electrons. This result has been interpreted as indicating that the energy levels associated with bombardment-produced defects form overlapping, degenerate impurity bands for the exposure in question. A.

538.224

490. MAGNETIC SUSCEPTIBILITY OF SODIUM METAL. R.Bowers.
Phys. Rev., Vol. 100, No. 4, 1141-4 (Nov. 15, 1955).

The total susceptibility of sodium metal has been measured from room temperature down to 55°K using the Gouy technique. The mass susceptibility at room temperature was found to be $+(0.70 \pm 0.03) \times 10^{-6}$ c.g.s. units. This result is analysed by using an estimate of the ion core susceptibility and calculations of the conduction-electron spin contribution. The analysis leads to a conduction-electron orbital diamagnetism

which is much smaller than the value obtained from the Landau–Peierls formula. No explanation is given of this disparity. The susceptibility decreases by 4.5% between room temperature and 55°K. No abnormal behaviour was found in the susceptibility between 77°K and 55°K where the Knight shift exhibits an anomaly. An account is given of experimental difficulty which were encountered in an attempt to measure the susceptibility at liquid helium temperatures. A.

538.224 : 537.226.32 : 621.318.1.013 : 621.319.2

491. REVERSAL IN THE MAGNETIC SUSCEPTIBILITY OF AN ELECTRET-FORMING MATERIAL. S.D.Chatterjee and N.G.Sutradhar.
Naturwissenschaften, Vol. 42, No. 12, 366 (1955).

The diamagnetic susceptibility of a small cylindrical electret of carnauba wax diminishes with time, after formation, passes through a minimum and then increases to the original value. This may be due to the liberation of electrons from polarized molecules during the state of high-field perturbation. These electrons are subsequently recaptured when the polarization decays. J.H.Mason

538.23

492. HYSTERESIS LOOPS OF MIXTURES OF FERROMAGNETIC MICROPOWDERS. C.P.Bean.
J. appl. Phys., Vol. 26, No. 11, 1381-4 (Nov., 1955).

A treatment is given of the hysteresis loops of dilute mixtures of various sizes of ferromagnetic particles. Three ranges of particle size are considered: very small particles called "super-paramagnetic" which are single domain and equilibrate resulting from thermal vibrations, single domain particles which are large enough not to equilibrate, and particles large enough to contain many domains in equilibrium. The results are compared with experiment. A.

538.24

493. PERMANENT-MAGNET PROPERTIES OF ELONGATED SINGLE-DOMAIN IRON PARTICLES. L.I.Mendelsohn, F.E.Luborsky and T.O.Paine.
J. appl. Phys., Vol. 26, No. 10, 1274-81 (Oct., 1955).

Previously described fine-particle magnets have been based upon crystal anisotropy; this paper reports permanent-magnet properties derived from the shape anisotropy of substantially elongated single-domain iron particles. The shape anisotropy of these particles overcomes the limitation imposed on the energy of previous fine-particle iron magnets by the low crystal anisotropy of iron. The predicted and observed properties of crystal anisotropy fine-particle magnets are reviewed and compared with an ideal fine-particle iron magnet based upon the shape-anisotropy model of Stoner and Wohlfarth. Experimental results are reported for magnets made by aligning and compacting single-domain iron particles 150 angstrom units in diameter, with a median length-to-diameter ratio of of three to one, and an intrinsic coercive force before packing of 1600 oersteds. The effect of particle alignment and packing fraction on magnetic properties is described, and energy products above three million gauss-oersteds are reported. These results are compared with properties predicted from theoretical considerations, and with existing permanent-magnet materials. A.

538.242

494. GYROMAGNETIC RATIO OF NICKEL AT LOW MAGNETIC INTENSITIES. G.G.Scott.
Phys. Rev., Vol. 99, No. 6, 1824-5 (Sept. 15, 1955).

It has recently been shown that the measured value for the gyromagnetic ratio of iron, as measured by an Einstein–De Haas experiment, is field-dependent in the low-intensity region, and that the extrapolated zero-intensity value of this ratio checks the value which is theoretically expected from a consideration of recent ferromagnetic resonance experiments. This experiment has been repeated for a sample of pure nickel and a similar result has been obtained. The extrapolated zero intensity value for g' for nickel is 1.801. At a higher induced magnetic intensity, the effective value of g' changes to 1.830. A.

538.247

495. THE INFLUENCE OF DEMAGNETIZATION METHOD ON THE PERMEABILITY OF IRON. J.Brož and J.Šternberk.
Czech. J. Phys., Vol. 5, No. 3, 425-8 (Aug., 1955). In Russian.

It is sometimes thought that all methods of demagnetizing a specimen of iron, say, are equivalent. The authors' experiments, however, on Armco and other types of iron, show that specimens demagnetized by an alternating magnetic field possess thereafter higher permeability than the same specimens demagnetized by heating above the Curie point and slowly cooling to room temperature. Further, the higher the frequency of the alternating demagnetizing field, the higher the subsequent values of Δ_μ plotted against H for the specimens when remagnetized. An explanation is put forward in terms of magnetic textures quoted in Vonsovskii and Shur's "Ferromagnetism". C.R.S.Manders

538.249 : 538.639

496. ON THE MAGNETORESISTANCE EFFECT IN METALS. R.A.Coldwell-Horsfall and D.ter Haar.
Phil. Mag., Vol. 46, 1149 (Oct., 1955).

Derives a general formula for the magnetoresistance on the basis of a one-band model with an energy-dependent time of relaxation. E.P.Wohlfarth

538.27 : 536.48

497. DE HAAS-VAN ALPHEN EFFECT IN ARSENIC. T.G.Berlincourt.
Phys. Rev., Vol. 99, No. 6, 1716-26 (Sept. 15, 1955).

This has been studied in single crystals of rhombohedral (metallic) arsenic in the liquid helium temperature range and in magnetic fields up to 25 kilogauss. The effect in arsenic is characterized by long-period (up to about 4×10^{-8} gauss^{-1}) oscillations upon which are superposed three short period (up to about 6×10^{-7} gauss^{-1}) terms. Analysis in terms of existing theory attributes the long-period oscillations to electrons occupying a constant energy surface in momentum or wave-number space which to a first approximation is an ellipsoid of revolution with a degeneracy energy $E_{01} = 1.59 \times 10^{-14}$ erg. The pertinent electrons in the case of the short-period oscillations can be attributed to three identical ellipsoidal constant-energy surfaces oriented so as to satisfy the trigonal symmetry of the arsenic lattice and having a degeneracy energy $E_{02} = 29.4 \times 10^{-14}$ erg. In addition, the electronic effective masses have been evaluated. A method for growing arsenic single crystals is described. A.

538.27 : 538.652

498. ANISOTROPY AND MAGNETOSTRICTION OF SOME FERRITES. R.M.Bozorth, E.F.Tilden and A.J.Williams.
Phys. Rev., Vol. 99, No. 6, 1788-98 (Sept. 15, 1955).

Magnetic crystal anisotropy and magnetostriction have been measured in various single crystals of ferrites having compositions represented approximately by MFe_2O_4, where M stands for Mn, Fe, Co, Ni and Zn in various proportions. Special attention is given to heat-treatment in a magnetic field. The magnetic anisotropy of cobalt ferrite at room temperature is as high as 4×10^6 ergs/cm^3. Magnetostriction is as high as 800×10^{-6}. Magnetic anneal is effective at temperatures as low as 150°C, and causes the hysteresis loop to become square. In polycrystalline material the response to magnetic anneal is a maximum at compositions intermediate between $CoFe_2O_4$ and Fe_3O_4. The constants for the various specimens are tabulated. Values of the anisotropy constants of $MnFe_2O_4$ at 20°C and −196°C are the same as those determined from ferromagnetic resonance experiments. At −196°C the constant for $Ni_{0.75}Fe_{2.25}O_4$ differs markedly from that determined by ferromagnetic resonance; this is to be expected from the relaxation phenomena observed by Galt, Yager and Merritt. A.

ELECTROMAGNETIC WAVES AND OSCILLATORS 538.56

538.56 : 532.5

499. HYDROMAGNETIC WAVES IN IONIZED GAS.
I. H. Piddington.
Nature (London), Vol. 176, 508 (Sept. 10, 1955).

It is reported that an equation has been derived for weak disturbances in an anisotropic medium of finite conductivity. The properties of the three types of hydromagnetic waves that may be propagated in a steady magnetic field depend on the relative intensities of the gas pressure and the "magnetic pressure" $H^2/8\pi$. R. A. Newing

538.56 : 532.51

500. THE STABILITY OF A HOMOPOLAR DYNAMO.
E. Bullard.
Proc. Cambridge Phil. Soc., Vol. 51, Pt 4, 744-60 (Oct., 1955).

The stability of the self-exciting disk dynamo is considered. If there is no electrical load in parallel with the field coil and no friction at the axle, the dynamo can perform oscillations of constant amplitude about its state of steady motion. Viscous forces on the axle cause the dynamo to settle to a steady motion. A parallel load may have an effect similar to that of viscous forces or may cause the oscillations to grow without limit. With both a parallel load and viscous forces the amplitude of the oscillations is bounded. Possible analogies between these results and the motion of a body of electrically conducting fluid in a magnetic field are discussed. The main applications are astronomical and geophysical. A.

538.561

501. NOTE ON PLASMA-ELECTRON OSCILLATIONS.
K.G.Emeleus and T.K.Allen.
Austral. J. Phys., Vol. 8, No. 2, 305-6 (June, 1955).

Short summary of results obtained in laboratory probe studies of plasma oscillations carried out with hot-cathode discharges in mercury vapour or argon at pressures of about 10^{-3} mm Hg. These results might be relevant to the theory that coronal plasma oscillations are responsible for certain forms of solar radio noise, as suggested by Wild et al. (Abstr. 15/1955). G.M.Brown

538.561 : 533.5 : 531.788.7

502. STUDY OF GYROMAGNETIC RESONANCE IN A PENNING GAUGE. G.Dumas.
Rev. gén. Elect., Vol. 64, No. 7, 331-49 (July, 1955). In French.

The discharge conditions in a Penning ionization gauge are investigated. There is interaction between the longitudinal motion which resembles that of a positive grid oscillator and the transverse circular gyromagnetic paths of natural frequency ω_B. The resulting oscillations are at $\omega_B/2$ and are sensitive to voltage and pressure as well as magnetic field strength. Oscillations at 400 Mc/s are produced with 320 gauss. Details of both the theory and experiment are given and are in agreement. D.H.Whiffen

538.565 : 621.372.413

503. CAVITY RESONATORS WITH NON-ORTHOGONAL BOUNDARIES. E.Ledinegg and P.Urban.
Acta. phys. Austriaca, Vol. 9, No. 3-4, 335-50 (1955). In German.

Relates to the problem of eigenvalue determination when the shape of the boundary does not permit separation of variables in any orthogonal system. The use of variational methods, perturbation methods, and normal-mode expansions are discussed. The finite perturbation of cavity walls is formulated in detail. It is shown that owing to rapidly increasing complexity, numerical results can hardly be carried further than the second-order terms. The normal-mode expansion can in principle allow more accurate solutions, as the determination of the higher terms proceeds independently of that of the lower ones. Convergence of the series is illustrated by reference to a particular example. E.A.Ash

538.566

504. LOCAL STUDY OF THE ELECTROMAGNETIC FIELD AT THE JUNCTION OF THREE DIELECTRIC MEDIA.
G. Weill.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 554-6 (Aug. 8, 1955). In French.

A formulation of the local electromagnetic field of a cylindrical wave, incident at the boundary of three differing dielectric media, bounded by half planes. G. D. Sims

538.566 : 621.372

505. ON A DIFFRACTION PROBLEM. P. Poincelot.
C.R. Acad. Sci. (Paris), Vol. 241, No. 8, 625-7 (Aug. 22, 1955). In French.

A plane harmonic wave is incident normally on a thin perfectly conducting screen of finite width and infinite length. The electric vector is parallel to the edges. An expression is found for the vector potential in terms of coefficients which can be evaluated from an infinite system of algebraic equations. See also Abstr. 2290B (1952); C.R. Acad. Sci. (Paris), Vol. 234, 513-15 (Jan. 28, 1952). S. C. Dunn (R)

538.566 : 621.396.11

506. ON RIGOROUS THEORY OF DIFFRACTION OF ELECTROMAGNETIC WAVES ON PLANE SCREENS.
K.Westpfahl.
Z. Phys., Vol. 141, No. 3, 354-73 (1955). In German.

The problem of diffraction of electromagnetic waves on plane, infinitely thin and ideally conducting screens of arbitrary shape is analysed using the Fitzgerald vector represented by a double Fourier integral. The Fourier amplitudes indicate intrinsically the angular distribution of the far field and a system of simultaneous integral equations is formulated for their determination; these can be solved approximately in a definite orthogonal system. Another solution can be obtained by using an iterative method which follows from Kirchhoff's approximation. The correlation between Huygen's Principle and the variation problem of the diffraction theory is established. Z.F.Wojnar

538.566 : 621.396.11

507. AN APPROXIMATE THEORY OF THE DIFFRACTION OF AN ELECTROMAGNETIC WAVE BY AN APERTURE IN A PLANE SCREEN. R.F.Millar.
Proc. Instn Elect. Engrs, Monogr. No. 152 R, publ. Oct., 1955, 9 pp. To be republished in Part C.

An approximate diffraction theory based on the Sommerfeld half-plane solution is developed. It is shown that, in certain regions, the electromagnetic field scattered (in the two-dimensional problem) by a perfectly conducting half-plane with plane waves incident can be conceived as arising from the flow of electric and magnetic currents along the edge of the half-plane. This edge-current concept is extended to the diffraction of normally incident plane waves by an aperture of arbitrary form in a thin, perfectly conducting screen of infinite extent. The approximation is for large apertures and is probably asymptotic. Interaction between the fiels scattered by different parts of the screen is neglected in the present treatment. Expressions are obtained for the tangential electric field in the aperture in terms of these edge currents. The case of the circular aperture is studied in some detail, axial and aperture field distributions being derived and compared with the experimental and theoretical data. Agreement with experiment and theory is fairly close, and improves with increase of the ratio of aperture radius to wavelength of incident radiation. A.

538.566 : 551.510.52

508. ON THE PROPAGATION OF ULTRA SHORT WAVES BEYOND THE HORIZON. K. Tao.

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Japan. J. Geophys., Vol. 1, No. 1, 28-79 (May, 1954).

The general theory of ultra-short waves in the diffraction region is treated theoretically. The propagation modes are considered from the stand-point of wave theory in the case where the troposphere consists of three inhomogeneous media, each refractive index of which varies linearly with height. The refractive index gradient is calculated from the aerological data and standard propagation is studied by comparing the observed values of the field strength with the theoretical values. The relationships between the field strength and the structure of the lower atmosphere and non-standard propagation are discussed briefly. A.

538.566 : 621.396.677

509. THE RADIATION OF AN ELECTRIC DIPOLE NEAR THE BOUNDARY BETWEEN TWO MEDIA. I.Šantavý.
Czech. J. Phys., Vol. 5, No. 3, 340-68 (Aug., 1955). In Russian, with summary (1 p.) in English .

The potential function of the non-stationary field is derived for a dipole with axis normal to the boundary, the electric moment being an arbitrary function of time. Cagniard's use of the Laplace transformation to study the propagation of seismic waves is extended to this problem. The derived functions are not directly suitable for numerical calculation. W.T.Blackband

538.566.2

510. ON THE THEORY OF THE PROPAGATION OF PLANE WAVES IN HOMOGENEOUS PLASMAS. G.Winkler.
Ann. Phys. (Leipzig), Vol. 16, No. 5-8, 414-28 (1955). In German.

A unitary treatment is given for the propagation of plane waves in infinite plasmas for a wide range of distribution functions of the charged particles. The dispersion formula is discussed for longitudinal waves (in thermal electron plasmas and in interacting electron beams), for transverse waves and for a general plane wave, considering also the oscillations of the positive ions. L.Pincherle

538.566.3

511. THE EQUIVALENCE THEOREMS OF IONOSPHERIC ABSORPTION. E.Argence, K.Rawer and K.Suchy.
C.R. Acad. Sci. (Paris), Vol. 241, No. 5, 505-7 (Aug. 1, 1955). In French.

A general theorem of equivalence can be obtained from the equations of propagation, taking account of partial reflection as well as electronic collisions. The theorem of Martyn and the results cited by Bremmer can be derived on certain assumptions. The case of strong absorption can be studied on the basis of the theory of a dispersive medium and metallic reflection. G.M.Brown

MOLECULAR AND ATOMIC STRUCTURE 539.1

THEORY OF SOLID STATE 539.11

539.11

512. EQUATION OF STATE FOR VAPOR–LIQUID–SOLID SYSTEM. I.Shimose.
J. Phys. Soc. Japan, Vol. 10, No. 10, 860-3 (Oct., 1955).

Generalizing the idea of order–disorder in alloy theory, it is possible to calculate the unified equation of state for a lattice gas with many interstitial sublattices to a degree of approximation similar to that developed by Bragg and Williams. For n = 9 (n is the number of sublattices), the concrete equation of state is estimated and the ratio of the number of molecules belonging to each sublattice to their total number is given as a function of molecular density. Then the critical temperature and density for vapour–liquid transition are estimated for n = 4, 9, 16. Furthermore, it is shown that the density region in the stable liquid phase is very narrow for n = 4, but that it becomes wider for n = 9, 16. A.

539.11 : 537.311 1

513. THE ELECTRON-PHONON INTERACTION, ACCORDING TO THE ADIABATIC APPROXIMATION. J.M.Ziman.
Proc. Cambridge Phil. Soc., Vol. 51, Pt 4, 707-12 (Oct., 1955).

The behaviour of the conduction electrons in a vibrating metallic lattice is treated by the Born–Oppenheimer method. Non-adiabatic processes, due to certain terms usually neglected, are shown to correspond to scattering of electrons by the lattice vibrations, as in Bloch's theory of electrical resistivity, but the matrix elements are not the same as Bloch's except when energy is conserved in the process. This may have important consequences in Fröhlich's theory of superconductivity. A

539.11 : 538.662

514. THERMOMAGNETIC ANISOTROPY. J.I.Kaplan.
Phys. Rev., Vol. 99, No. 6, 1808-10 (Sept. 15, 1955).

A solution of the Boltzmann transport equation in a solid is given for applied electric and magnetic fields and a temperature gradient. The energy surfaces are assumed to be ellipsoids and the density of states is such that Fermi statistics are applicable. It is shown that the calculated kinetic reciprocal coefficients which define the electric and heat currents satisfy the generalized Onsager relations. A.

539.11 : 548.7

515. ENERGY LEVELS OF A CRYSTAL MODIFIED BY ALLOYING OR BY PRESSURE. R.H.Parmenter.
Phys. Rev., Vol. 99, No. 6, 1759-66 (Sept. 15, 1955).

A perturbation method of calculating the energy levels of a crystal modified by alloying or by pressure is studied. Initially the calculation is developed by means of conventional first-order perturbation theory. It is then shown what is wrong with this approach and how the calculation can be improved by a modified form of perturbation theory. It is further shown that this modified form of perturbation theory is particularly appropriate to cases where the unperturbed wave-functions are expanded in terms of orthogonalized plane waves. A

539.11 : 548.7

516. SPIN-ORBIT COUPLING EFFECTS IN ZINC BLENDE STRUCTURES. G.Dresselhaus.
Phys. Rev., Vol. 100, No. 2, 580-6 (Oct. 15, 1955).

Character tables for the "group of the wave vector" at certain points of symmetry in the Brillouin zone are given. The additional degeneracies due to time reversal symmetry are indicated. The form of energy v. wave-vector at these points of symmetry is derived. A possible reason for the complications which may make a simple effective mass concept invalid for some crystals of this type structure is presented. A.

MOLECULES 539.13

539.13

517. LONG RANGE FORCES BETWEEN HYDROGEN MOLECULES. F.R.Britton and D.T.W.Bean.
Canad. J. Phys., Vol. 33, No. 11, 668-78 (Nov., 1955).

Long-range forces between two hydrogen molecules are calculated by using methods developed by Massey and Buckingham. Several terms omitted by them and a corrected numerical factor greatly change results for the van der Waals energy but do not affect their results for the static quadrupole–quadrupole energy. By using seven approximate ground state H_2 wave functions information is obtained regarding the depend-

ence of the van der Waals energy on the choice of wave function. The value of this energy averaged over all orientations of the molecular axes is found to be approximately $-11.0\ R^{-6}$ atomic units, a result in close agreement with semiempirical values. A.

539.132

518. LEAST-SQUARES CALCULATION OF OVFF FORCE CONSTANTS FOR XY_4 TETRAHEDRAL MOLECULES. W.S.Horton.
J. chem. Phys., Vol. 23, No. 9, 1727 (Sept., 1955).

The necessity of using weighting factors is pointed out, particularly in an application of the method to the interpretation of the $TiCl_4$ spectrum. J.Jacobs

539.132

519. PREDICTION OF MADELUNG CONSTANTS. D.H.Templeton.
J. chem. Phys., Vol. 23, No. 10, 1826-9 (Oct., 1955).

Madelung constants of both simple and complex salts can be reduced to a common scale by taking the nearest-neighbour distance as the unit distance and then dividing by half the sum of the squares of the charges of all the atoms in the stoichiometric unit. These "reduced Madelung constants", α, can be predicted within a few per cent by the relation $\alpha = 1.89 - 1/m$, where m is the harmonic mean coordination number. Madelung constants have been calculated for LaOCl, YOF, ReO_3 and several perovskite structures for comparison with the predictions. A.

539.132 : 534.222.2 : 533.75

DISSOCIATION ENERGY OF NITROGEN FROM SHOCK WAVE DATA. See Abstr. 135.

539.132

520. VARIATION WITH VIBRATION OF THE FLUORINE SPIN—ROTATION INTERACTION IN Li^6F. S.O.Kastner, A.M.Russell and J.W.Trischka.
J. chem. Phys., Vol. 23, No. 9, 1730 (Sept., 1955).

From molecular beam resonance experiments on Li^6F for $J = 2$, $m_J\ 2 \rightarrow 0$, $c/h = 36.28, 36.11$ and 33.89 kc/s for $v = 0, 1, 2$ respectively, where c is the coefficient of I.J in the Hamiltonian. The non-linear change in c with v is ascribed to the electronic contribution fo c. D.H.Whiffen

539.132

521. STRUCTURE AND POTENTIAL BARRIER TO HINDERED ROTATION IN METHYL ALCOHOL. J.D.Swalen.
J. chem. Phys., Vol. 23, No. 9, 1739-40 (Sept., 1955).

The calculated and measured values of the frequencies of the $J = 0 \rightarrow 1$ line in the six isotopic species $C^{12}H_3OH$, $C^{13}H_3OH$, $C^{12}H_3OD$, $C^{13}H_3OD$, $C^{12}D_3OH$, $C^{12}D_3OD$ are tabulated. The parameters of the methyl alcohol molecule are deduced and compared with previously recorded values.
G.I.W.Llewelyn

539.132

522. PYRAMIDAL $XY(CH_3)_2$ MOLECULAR MODEL CLASSICAL VIBRATION PROBLEM. H.C.Beachell, B.Katlafsky and J.L. Lauer.
J. chem. Phys., Vol. 23, No. 11, 2171-8 (Nov., 1955).

Symmetry coordinates are set up from the standpoint of group theory for describing the normal modes of vibration of a valence force pyramidal $XY(CH_3)_2$ molecular model in such a way that maximum factorization of the secular determinant is accomplished. The kinetic energy matrix is set up and an analytical expression is given for each matrix element in terms of the reciprocal bond distances, reciprocal masses of the atoms, and the bending and twisting angles. A valence force and a Urey—Bradley field potential is discussed. A.

539.132

523. PROTON TRANSFER IN HYDROGEN BOND AND ITS PARTICIPATION IN π-ELECTRON SYSTEMS. I.Oshida, Y.Ooshika and R.Miyasaka.
J. Phys. Soc. Japan, Vol. 10, No. 10, 849-59 (Oct., 1955).

The infrared spectra of OH or NH groups in 3μ region H bonds are divided into two (or three) types according to their wave-lengths and intensities. The first group is of the alcoholic type, and the second group is observed when conjugated π-electron systems combine the hydrogen bonds, and when the effect of proton transfer across the hydrogen bond and the "antenna effect" are important. Proton transfer is discussed qualitatively and numerical calculations are carried out with simple symmetrical double minimum potentials. The linear combination method of solving such problems is shown to be numerically incorrect, though it is convenient for a qualitative consideration. Further evidence, and the biological importance, of hydrogen transfer participating in π-electron systems are discussed. A.

539.132

524. MAGNITUDE OF THE SPLITTING OF THE LOWEST LEVEL IN CHROMIUM ALUM. P.H.E.Meijer and H.J.Gerritsen.
Phys. Rev., Vol. 100, No. 2, 742 (Oct. 15, 1955).

Contains the results of a recalculation of the lowest energy levels of the chromium ion in chromium potassium alum. After diagonalization of the Hamiltonian of the electric field, the spin-orbit coupling is introduced and the spin Hamiltonian of the lowest level calculated by a formal method. The numerical value differs from those published previously. The result is a different value for the parameter a (radial average of the cylindrical field). A.

539.132

525. QUADRUPOLE RESONANCE AT LOW TEMPERATURE. D.Dautreppe.
Onde élect., Vol. 35, 487-8 (May, 1955). In French.

A note on the significance of and apparatus for the measurement of relaxation times at temperatures down to that of liquid He. A.E.De Barr

539.132

526. MAGNETIC HYPERFINE STRUCTURE DUE TO ROTATION IN $^1\Sigma$ MOLECULES. R.L.White.
Rev. mod. Phys., Vol. 27, No. 3, 276-88 (July, 1955).

A review of the theory of the magnetic coupling of nuclei and overall rotation (I.J coupling) and g_J (electronic) values for $^1\Sigma$ molecules. Experimental values from both electric and magnetic resonance electric beam experiments and microwave spectroscopy are tabulated. New coupling constants from microwave measurements for various isotopic species in ClF, OCS, OCSe, ClCN, CH_3Cl, GeH_3Cl and SiH_3Cl are given. D.H.Whiffen

539.132

527. STUDY OF NUCLEAR QUADRUPOLE RESONANCE. DETECTION AND APPLICATIONS. M. Buyle-Bodin.
Ann. Phys. (Paris), Vol. 10, 533-83 (July-Aug., 1955). In French.

A thesis which includes the detailed theory of quadrupole resonance including the case of hindered rotation, circuit diagrams for frequency-modulated super-reactive spectrometers for 10-60 Mc/s and 200-400 Mc/s. The results from Zeeman-effect investigation of a p-dichlorbenzene crystal show the Cl—Cl axes to be inclined at $75^\circ\ 30' \pm 2^\circ\ 30'$. From temperature-variation measurements on CCl_3COOH the barrier height for CCl_3 rotation is about 4 kcal, and for $CH_2Cl—CH_2Cl$ about 3 kcal. D. H. Whiffen

539.132

528. CHLORINE NUCLEAR QUADRUPOLE RESONANCES IN SOLID SOLUTIONS. C.Dean.

J. chem. Phys., Vol. 23, No. 9, 1734-5 (Sept., 1955).

Broad Cl^{35} quadrupole resonance absorption occurs when Cl and Br both occur as crystal neighbours to the Cl nucleus as in p-brom-chlor-benzene or 50% mixtures of p-dichlor- and p-dibrombenzene. For dilute solutions in p-dibrombenzene the lines are narrow and 10-50 kc/s higher in frequency than the p-dichlorbenzene reference. D.H.Whiffen

539.132

529. LIMITS OF POLARIZATION OF AN ATOMIC SYSTEM SUBJECTED TO A RADIOFREQUENCY FIELD. C.Bloch and A.Messiah.
J Phys. Radium, Vol. 16, No. 10, 785-97 (Oct., 1955). In French.

If a system with a number of spin states (electron and nuclear) is subjected to an intense resonance radiofrequency field which causes transitions between two states, the populations of all the states may be altered in a way which depends on the transition probabilities and relaxation times when the system is in a thermostat. Limiting populations for saturating radiofrequency fields are evaluated for special cases and discussed in terms of interaction diagrams. D.H.Whiffen

539.132

530. CHEMICAL SHIFTS OF NITROGEN. B.E.Holder and M.P.Klein.
J. chem Phys., Vol. 23, No. 10, 1956 (Oct., 1955).

N^{14} chemical shifts are given for 17 compounds of which the largest is +6.02 in 10 000 gauss for NH_4^+ ion relative to the NO_3^- ion, which is taken to provide the standard nuclear magnetic resonance frequency. D.H.Whiffen

539.132

531. ON PROTON CHEMICAL SHIFT IN AMMONIA. B.N.Bhar.
J. chem. Phys., Vol. 23, No. 10, 1972 (Oct., 1955).

It is suggested that an increase of pressure should lower the field strength for proton magnetic resonance of substances, such as NH_3, which form intermolecular hydrogen bonds. D.H.Whiffen

539.132

532. ELECTRON SPIN COUPLING IN POLYATOMIC MOLECULES. R.S.Henderson.
Phys. Rev., Vol. 100, No. 2, 723-9 (Oct. 15, 1955).

A formula to describe the splitting of rotational energy levels in polyatomic molecules, brought about by interaction of the magnetic field produced by rotation with electron spin and orbital angular momenta, is derived by perturbation methods on the basis of simplifying assumptions. The formula is then fitted to experimental data obtained from observations on fine structure in the spectrum of chlorine dioxide. The agreement is quite satisfactory. A.

539.132

533. OBSERVATION OF NUCLEAR QUADRUPOLE RESONANCES WITH A COAXIAL-CAVITY SPECTROMETER. S.Kojima, A.Shimauchi, S.Hagiwara and Y.Abe.
J. Phys. Soc. Japan, Vol. 10, No. 11, 930-3 (Nov., 1955).

A super-regenerative spectrometer with a two-cavity grid-separation oscillator from a lighthouse tube was constructed and operated in the frequency region between 700 and 1000 Mc/s. With this spectrometer, nuclear quadrupole resonances of I^{127} in solid NH_4I_3 and ICl were observed. The coupling constants for NH_4I_3 and ICl were 2440 and 3008 Mc/s at room temperature, and the asymmetry parameters were 1.8% and 2.0% respectively. A.

539.132

534. ON THE REPRESENTATIONS, CALCULATION AND INDEFINITE CORRECTION OF THE ERROR IN THEORETICAL CHEMISTRY. II. A.Laforgue.
Cahiers de Phys., No. 59, 16-39 (July, 1955). In French.

For Pt I, see Abstr. 8961 (1955). The general scheme for discussing errors in MO method having been derived, new approximations arose for H_2 which are here extended to H_3. General conclusions are that the method of configuration interaction based on only approximately orthogonal orbitals is dangerous, as is the ignoring of highly excited configurations; and minimization of the energy does not necessarily approach the correct functions, as the choice of the initial functions is significant. J.Jacobs

539.132

535. ON THE STRUCTURE OF ETHYLENE. A.V.Stuart.
J. chem. Phys., Vol. 23, No. 9, 1726 (Sept., 1955).

A critical examination of the method of semilocalized orbitals used by Mueller for C_2H_4. The parameter p (ratio of ionic to covalent terms) is described as hardly significant. J.Jacobs

539.132

536. DELOCALIZATION AND APPROXIMATION METHODS. C.R.Mueller.
J. chem. Phys., Vol. 23, No. 9, 1726-7 (Sept., 1955).

A reply to the criticisms made by Stuart (preceding abstract) defending the variational method used by Mueller and Craig. J.Jacobs

539.132

537. LONDON FORCE CONTRIBUTIONS TO BOND ENERGIES. K.S.Pitzer.
J. chem. Phys., Vol. 23, No. 9, 1735 (Sept., 1955).

It is shown that inclusion of the London term (proportional to R^{-6}) reduces the anomaly of the single bond lengths in the F_2, Cl_2 .....series. J.Jacobs

539.132

538. THE RÔLE OF HYDROGEN BONDING IN THE $n \rightarrow \pi^*$ BLUE-SHIFT PHENOMENON. G.J.Brealey and M.Kasha.
J. Amer. Chem. Soc., Vol. 77, No. 17, 4462-68 (Sept. 5, 1955).

The change in the position of the $n \rightarrow \pi^*$ absorption bands on changing from a hydrocarbon to a hydroxylic solvent has been investigated for a number of molecules. The large shift to shorter wavelengths (blue-shift) is shown to be mainly due to hydrogen-bonding of the n-electrons by the hydroxylic solvent, which causes a greater stabilization of the ground state compared with the excited state of the molecule. Pyridazine and benzophenone have been examined in detail in a series of different mixtures of hexane and ethanol. The families of spectra obtained indicate that essentially two species are involved, a hydrogen bonded and a non-hydrogen bonded form and it is the formation of the hydrogen bonded species that causes the main shift of the $n \rightarrow \pi^*$ transition to the blue. From the ultraviolet data, an association constant of hydrogen bonding can be obtained and this agrees well with the association constant found by a study of the association of ethanol with the molecule in the infrared. The infrared work makes use of the shift in the O–H stretching frequency on formation of a hydrogen bond. A.

539.133

539. THE APPLICATION OF ELLER'S OPTICAL MACHINE TO THE STUDY OF THE STRUCTURE OF GASEOUS MOLECULES BY MEANS OF ELECTRON DIFFRACTION. L.Brú, J.M.García García and M.Pérez Rodríguez.
An. Real Soc. Españ. Fís. Quím., Vol. 51 (A), No. 7-8, 163-72 (July-Aug., 1955). In Spanish.

The integrals of electron diffraction can be performed by Eller's machine, in which rotating diaphragms and shaped masks, placed in an optical system, give a photographic record of the integration. A description of the machine is included, and sample results are shown. R.W.Fish

539.133 : 535.343

540. MOLECULAR STRUCTURE OF METHYLAMINE FROM ITS MICROWAVE SPECTRUM. T.Nishikawa, T.Itoh and K.Shimoda.
J. chem. Phys., Vol. 23, No. 9, 1735-6 (Sept., 1955).

A re-examination of the spectrum of methylamine gives: A = 37.085, B = 38.662, C = 8.136, C_1 = 2.805, C_2 = 5.331 and D = -0.120×10^{-40} g.cm^2; α = 11.344; Δ_0 = 28 604 and 29 358 Mc/s for n = 0 and 1 respectively. Molecular dimensions are C—H = 1.093 (assumed), N—H = 1.014 (assumed), C—N = 1.474 ± 0.005 A; ∠ HCH = 109° 30' ± 1°, ∠ HNH = 105° 50' ± 1°, ∠ CNH = 112° 10' ± 1°, angle between C—N and CH_3 axis = 3° 30' ± 20' with CH_3 axis passing through NH_2 triangle. Barrier height = 691.1 ± 1.0 cm^{-1}. D.H.Whiffen

539.133 : 535.343

541. INTERNAL BARRIER HEIGHT OF METHYL MERCAPTAN. R.W. Kilb.
J. chem. Phys., Vol. 23, No. 9, 1736-7 (Sept., 1955).

The $0_{00} \rightarrow 1_{11}$ transition near 25 000 Mc/s of CH_3SH is analysed for various isotopic molecules. The spectra are consistent with the structure: C—H = 1.1039 ± 0.0020, S—H = 1.3291 ± 0.0040, S—C = 1.8177 ± 0.0002 A; ∠ HCH = 110° 16' ± 10', ∠ CSH = 100° 16' ± 10', angle between C—S bond and CH_3 axis = 27.5' ± 17'; barrier height = 705 ± 45 cal. D.H.Whiffen

539.133

542. STRUCTURE OF FERROCENE. E.A.Seibold and L.E.Sutton.
J. chem. Phys., Vol. 23, No. 10, 1967 (Oct., 1955).

The Fe—C, C—C, and C—H bond lengths in ferrocene were determined by an electron diffraction study on the vapour at 400° C. The results are in good agreement with the highly symmetrical "sandwich" structure proposed by Wilkinson, ref. (J. Amer. Chem. Soc., Vol. 74, 2125, 1952).
G.I.W.Llewelyn

ATOMS. NUCLEUS. ISOTOPES 539.15

539.152.1

543. SHELL THEORY OF THE NUCLEUS. E.Feenberg.
London: Oxford University Press (1955), 244 pp. (Investigations in Physics No. 3, Princetown University Press).

"This is a full length report on nuclear shell structure and related problems. The understanding of nuclear shell structure has developed in three overlapping stages. This volume is a guide to the developments of the second stage for readers who are familiar with the elements of nuclear physics and quantum theory. Ideas and results belonging to the first and third stages are also discussed."

539.152.1

544. SPECIAL FEATURES OF THE "SPECIAL" ZONES. M.A.Levitskaya.
Zh. éksper. teor. Fiz., Vol. 29, No. 2(8) 158-65 (1955). In Russian.

Twenty special features of nuclei in the special zones (intervals of Z from 16—20, 28—38, etc.) are noted.
G.E.Brown

539.152.1

545. THE COURSE OF THE BINDING ENERGY. A.Fisch.
Helv. phys. Acta, Vol. 28, No. 4, 341-3 (1955). In German.

Further remarks on the lines of Abstr. 3030 (1955) where it was noted that the packing fraction is not constant.
W.J.Swiatecki

539.152.1

546. NUCLEAR SPIN AND HYPERFINE STRUCTURE OF RADIOACTIVE SILVER, $^{111}_{47}$Ag. G.K.Woodgate and R.W.Hellwarth.
Nature (London), Vol. 176, 395-6 (Aug. 27, 1955).

Atomic beam magnetic resonance experiments give: I = 1/2, $\Delta\nu$ = 2204.54 ± 0.05 Mc/s for the transition F = 1 ↔ 0, m_F = 0 ↔ 0, g_J ($^2S_{\frac{1}{2}}$) = 2.00 242 ± 0.00 011, μ_I = − 0.145 n.m. D.H.Whiffen

539.152.1

547. A NOTE ON THE GROUND STATE SPIN OF ^{177}HAFNIUM. B.Hartmann and T.Wiedling.
Phil. Mag., Vol. 46, 1139-41 (Oct., 1955).

The angular correlation of the two strong gamma-ray lines in the decay scheme of Hf^{177} was measured using different chemical compounds. From the measured correlation coefficient it was not possible to decide between the spin sequences 9/2 → 7/2 → 5/2 and 5/2 → 5/2 → 1/2, and so no certain conclusion can be drawn about the spin of the ground state of Hf^{177}. J.Hughes

539.152.1

548. INDEPENDENT-PARTICLE MODEL OF THE NUCLEUS. II. WEAK SURFACE COUPLING. K.W.Ford and C.Levinson.
Phys. Rev., Vol. 100, No. 1, 1-12 (Oct. 1, 1955).

For Pt I, see Abstr. 8993 (1955). The role of weak surface coupling is discussed for multi-particle nuclear configurations. Matrix elements are given for the standard form of the coupling of nucleons to nuclear surface vibrations. Energy spacings, configuration interaction, magnetic moments, quadrupole moments, and E2 transition rates are discussed, with emphasis on features independent of special details of particle configurations. Magnetic moments, in particular, become orderly when account is taken of variations of surface coupling strength together with a directly induced configuration mixing. Experimental evidence favours the idea that a true weak coupling situation exists for many nuclei near closed shells. In these nuclei, collective quadrupole effects may be appreciable while all other collective effects are negligible. A.

539.152.1

549. INDEPENDENT PARTICLE MODEL OF THE NUCLEUS. III. THE CALCIUM ISOTOPES. C.Levinson and K.W.Ford.
Phys. Rev., Vol. 100, No. 1, 13-21 (Oct. 1, 1955).

The isotopes of calcium of mass number 41, 42 and 43 are analysed using the methods given in Pt I and II. It is found that the experimental data on Ca^{41} and Ca^{43} is sufficient to predict the low-lying odd-parity levels of Ca^{43} as well as the magnetic moment. Detailed agreement between theory and experiment is obtained for the levels of Ca^{43} of spin and parity 7/2$^-$, 5/2$^-$, 3/2$^-$, and 9/2$^-$ and the experimental Schmidt line magnetic moment deviation of 0.595 n.m. is in agreement with a predicted deviation of 0.60 n.m. The relative importance of particle forces and surface forces due to collective motion is investigated and it is concluded that for the isotopes investigated the surface forces are so weak as to have a negligible effect on the level spacings. As a measure of the upper limit of the strength of the surface forces the magnitude of $\hbar\omega$ (the surfon energy) is set at greater than about 15 MeV. An effective two-particle interaction potential is derived which differs to some extent from the two-particle scattering potential in that it has a longer range and is more shallow. A.

539.152.1

550. ISOTOPIC SPIN IMPURITY IN LIGHT NUCLEI. I. CORE IMPURITY. W.M.MacDonald.
Phys. Rev., Vol. 100, No. 1, 51-7 (Oct. 1, 1955).

The introduction of isotopic spin impurity by the Coulomb mixing of different nuclear eigenstates of T^2 can occur both through the perturbation of the wave-function for nucleons in a J, T = 0 core by the Coulomb interaction of nucleons in the core, and through the perturbation of the wave-function for

nucleons outside the core by their Coulomb interaction with nucleons in the core and with each other. In this paper the core impurity, the sum of the squared amplitudes of higher isotopic spin eigenstates ($T \neq 0$), is calculated for the ground state of N = Z even-even nuclei on the Fermi gas model. The core impurity is found to exceed by a large factor the isotopic spin impurity in the wave-function for nucleons outside the core. A.

539.152.1

551. NUCLEAR RADIUS AND NUCLEAR FORCES. S.D.Drell.
Phys. Rev., Vol. 100, No. 1, 97-112 (Oct. 1, 1955).

The difference between the radius of the nuclear matter distribution and the nuclear force radius, $R_N \simeq 1.4A^{1/3} \times 10^{-13}$cm, for heavy nuclei (A > 100) is interpretated as a consequence of the finite range of nuclear forces. Assuming that the nuclear matter distribution coincides with the charge distribution as determined at Stanford ($R_C = 1.12A^{1/3} \times 10^{-13}$ cm is the distance at which the charge density falls to one half value) the nuclear interactions of an incident nucleon for various proposed internucleon potentials, V(r) are summed up. Contributions from the spin, charge, and matter polarizations induced in the nuclear distributions by the incident nucleon are also evaluated as a test of the convergence of these calculations. The aim is to infer some features of nuclear forces which satisfy saturation requirements and at the same time give rise to an appreciable nuclear attraction for an incident nucleon at R_N. Analyses of the scattering of neutrons and protons by heavy nuclei suggest a nuclear attraction A >about 14 MeV at a distance R_N. These considerations are primarily sensitive to the long range behaviour of the direct, central part of V(r). The key point which emerges from them is that the nuclear forces must contain long range (about meson Compton wavelength) direct, central attractions which will be felt by an incident nucleon at R_N before the shorter range repulsions (hard cores, many-body forces, or exchange interactions), which are responsible for saturation, become effective. Such interactions can be constructed phenomenologically, but are not found in recent meson-theoretically deduced potentials. A.

539.152.1

552. LOCALIZED ORBITALS IN NUCLEAR STRUCTURE. R.K.Nesbet.
Phys. Rev., Vol. 100, No. 1, 228-34 (Oct. 1, 1955).

A generalization of the alpha-particle model of nuclear structure is developed, in which even-even nuclei or inner cores of odd nuclei are built up from localized spatial cells occupied either by two neutrons or by two neutrons and two protons. The analysis used is based on general properties of solutions of Hartree–Fock equations and on the effects of configuration interaction for a neutron-proton system governed by a Hamiltonian of the form $\Sigma K(i) + \Sigma Q(i,j)$. It is not necessary to specify the operators K and Q exactly, except that the interaction operator Q is assumed to be primarily an attractive interaction of short range. A semi-empirical binding energy formula is derived which gives close agreement with observed binding energies for stable even-even nuclei lighter than Ca^{40}. For a reasonable value of a parameter not determined by these data, the energy formula predicts that Ti^{44} should be unstable. A.

539.152.1

553. AGREEMENT OF CLASSICAL AND QUANTUM COULOMB EXCITATION INTEGRALS. J.P.Lazarus and S.Sack.
Phys. Rev., Vol. 100, No. 1, 370-2 (Oct. 1, 1955).

A comparison is made between classical and quantum Coulomb excitation integrals. Use is made of a relation due to Breit and Daitch (to be published) concerning close equality of classical and quantum density integrals. It is shown that the indefinite Coulomb excitation integrals show agreement at nearly the same distances as the corresponding density integrals. The agreement of the Coulomb excitation integrals for small excitations is therefore believed to be caused at least partly by the agreement of the density integrals. A.

539.152.1

554. QUANTUM CALCULATION OF COULOMB EXCITATION. I. L.C.Biedenharn, J.L.McHale and R.M.Thaler.
Phys. Rev., Vol. 100, No. 1, 376-93 (Oct. 1, 1955).

A complete quantum mechanical treatment for Coulomb excitation is presented. Angular correlations as well as total cross-section are developed. The reduction to a form suitable for computation of the radial Coulomb integrals which are needed to evaluate the transition matrix elements is discussed in detail. The relation of the quantum mechanical treatment to the classical treatment is established, and it is shown that the results may be presented as the classical result plus a quantum mechanical correction. A.

539.152.1 : 539.185

555. ANGULAR DISTRIBUTION AND POLARIZATION OF 3.4 MeV NEUTRONS SCATTERED BY LEAD AND BISMUTH. H.R.Brugger, H.J.Gerber, B.Lüthy and A.E.Remund.
Helv. phys. Acta, Vol. 28, No. 4, 331-3 (1955). In German.

The experimental results are in fairly satisfactory agreement with the "cloudy crystal ball" nuclear model of Weisskopf et al. A.O.Stanesby

539.152.2

556. CONTRIBUTION TO THE STUDY OF THE SHAPES AND BREADTHS OF RAYS IN NUCLEAR RESONANCES. Y.Ayant.
Ann. Phys. (Paris), Vol. 10, 489-532 (July-Aug., 1955). In French.

A full theoretical treatment of nuclear relaxation and signal shapes, including spin–spin and spin–lattice interactions in quadrupole resonance and the effect of slow and rapid rotations and librations. Also nuclear magnetic resonance in liquids, both with and without quadrupole effects, is treated. D.H.Whiffen

539.152.2

557. MAGNETIC MOMENT OF THE PROTON. D.J.Collington, A.N.Dellis, J.H.Sanders and K.C.Turberfield.
Phys. Rev., Vol. 99, No. 5, 1622-3 (Sept. 1, 1955).

Measured by a modification of the method used by Jeffries (Abstr. 5662/1951). The modification consists of separating the grounded dees by a straight-sided conductor fed from an r.f. voltage source at approx. the eighth harmonic of the cyclotron frequency. In this method a larger number of revolutions can be observed than in that of Jeffries, giving narrower peak widths in determining the cyclotron frequency. After correcting for the diamagnetism of the water sample, the result obtained for the magnetic moment of the proton was 2.79281 ± 0.000 04 nuclear magnetons. J.Hughes

539.152.2

558. PRELIMINARY MEASUREMENT OF THE MAGNETIC MOMENT OF THE EXCITED STATE OF F^{19} AT 197 keV. P.Lehmann, A.Lévêque and M.Fiehrer.
C.R. Acad. Sci.(Paris), Vol. 241, No.11, 700-2 (Sept. 12, 1955). In French.

A value 4.0 ± 0.9 nuclear magnetons is deduced from the observed perturbation, by a magnetic field, of the angular distribution of 197 keV γ-rays following inelastic scattering of protons by F^{19}. J.J.Wilkins

539.152.2

559. THE QUADRUPOLE MOMENT OF La^{139}. K.Murakawa.
J. Phys. Soc. Japan, Vol. 10, No. 11, 927-9 (Nov., 1955).

The hyperfine structure of the spectra of La I and La II was studied, and data that are more accurate than the previous

vestigation were obtained. These data, together with an improved value of the screening correction of the d-electron, yielded the result that the quadrupole moment of La^{139} is $(.6 \pm 0.2) \times 10^{-24}\,cm^2$, in which the polarization correction ue to Sternheimer is taken into account. A.

539.152.2

560. EMPIRICAL CORRELATION OF NUCLEAR MAGNETIC MOMENTS. R.K.Osborn and E.D.Klema.
hys. Rev., Vol. 100, No. 3, 822-34 (Nov. 1, 1955).

A simple generalization of the extreme shell model, ased upon the kinematics of the collective model, is proposed for the correlation of nuclear magnetic moments. It is nown that, if the concept of a rotating core is adjoined to that the single-particle model, largely in disregard of dynamical onsiderations, then by the aid of three simple empirical rules round state wave-functions may be easily constructed which orrectly express the parities, spins, and magnetic moments f all nuclei for which A is equal to or greater than 7, with ie exception of W^{183}. The choice of a particular set of empirical rules was dictated primarily by the twofold desire to keep ieir number to a minimum and at the same time restrict the onsequent wave-function to but two components; hence, considerable oversimplification of the true state of affairs is invitable. However, the internal consistency of the results oes point up strikingly the previously observed, but not explicitly investigated, possibility that the nature of the variable egrees of freedom required for generalization of the single-article model may differ fundamentally for $j = l + 1/2$ in contrast to $j = l - 1/2$ single-particle configurations — being redominantly those of the core in the former instance and hose of the single particle in the latter. A.

539.152.2 : 535.338.333

SPIN OF U AND Pu ISOTOPES FROM HYPERFINE PECTRA. See Abstr. 212.

539.152.2 : 539.132

561. NUCLEAR SPIN-LATTICE RELAXATION IN SOLID HYDROGEN. T.Sugawara.
Phys. Rev., Vol. 100, No. 2, 759 (Oct. 15, 1955).

539.153

562. ON THE THEORY OF THE ELECTRON AFFINITY OF THE Na AND K ATOMS. R. Gáspár and B. Molnár.
Acta phys. Hungar., Vol. 5, No. 1, 75-81 (1955). In German.

The electron affinity was calculated by the variational nethod of Gombás (Abstr. 1149/1944). Neglecting the small olarization and exchange interactions, the calculations gave he value of 0.84 and 0.82 eV for Na and K respectively, in greement with the calculations of other workers. J. Hughes

539.153

563. ELECTRON AFFINITY OF BORON, CARBON, NITROGEN, AND OXYGEN ATOMS. T.-Y.Wu.
Phys. Rev., Vol. 100, No. 4, 1195-6 (Nov. 15, 1955).

The electron affinities have been calculated by the method of Bacher and Goudsmit which enables the energy of a state in an n-electron configuration to be calculated in terms of the spectroscopic values of the energies of states of the (n–1)-, (n–2)-, ..., 1-electron ions. The negative ions of boron and nitrogen are found to be unstable, the electron affinity being about –0.14 and –0.72 eV, respectively. The electron affinities of carbon and oxygen atoms are 1.75 and 1.13 eV, respectively. The last value is in fair agreement with the recently observed values, 1.48 eV found by Branscomb and Smith, and 1.05 found by Schüler and Bingel. A.

539.153 : 537.531

564. DIPOLE AND QUADRUPOLE TRANSITIONS OF CERTAIN ELEMENTS (Z = 83, 82, 78, 74). CALCULATION OF THE RADIATION WIDTHS AND RELATIVE INTENSITIES OF THE CORRESPONDING X-RAYS. W.Laskar.
J. Phys. Radium, Vol. 16, No. 8-9, 644-9 (Aug.-Sept., 1955). In French.

The results of relativistic calculations for 22 transitions in each of the elements Bi^{83}, Pb^{82}, Pt^{78} and W^{74} are presented in tables and curves, and are discussed together with existing experimental data. J.J.Wilkins

539.153 : 539.132

565. LOCALIZABILITY OF ELECTRONS IN ATOMS AND MOLECULES — APPLICATION TO THE STUDY OF THE NOTION OF SHELL AND OF THE NATURE OF CHEMICAL BONDS. R.Daudel, H.Brion and S.Odiot.
J. chem. Phys., Vol. 23, No. 11, 2080-3 (Nov., 1955).

The importance of the correlations existing between the positions of electrons in atoms and molecules has recently been stressed. A new method for the study of these correlations is presented here. It consists in the decomposition of the space of an electronic system into small parts where there is a very large probability of finding one and only one electron of a given spin. This method allows the association of spherical rings to the shells of atoms and the association of space to the atomic core and to the bonds of molecules. A.

539.153.4

566. TRANSITIONS OF SEVERAL ELECTROMAGNETIC QUANTA. J. Margerie and J. Brossel.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 373-5 (July 25, 1955). In French.

If the magnetic field H_1 (perp. to H_0) producing the transition between two atomic levels is linear, it is decomposed into an active and an inactive part. Calculations of transition probability have shown a resonance shift. If then the quantum system is subjected to two kinds of photons ($\pm\omega$) carrying ± 1 units of kinetic moment, there occur, in addition to the classical transition $\omega = \omega_0$, the transitions $3\omega = \omega_0$, $5\omega = \omega_0$, ... If H_1 is parallel to H_0, transitions with $n\omega = \omega_0$ are possible, n even or odd. J. Jacobs

539.153.4

567. STUDY OF TRANSITIONS JUMPING SEVERAL QUANTA BETWEEN TWO ATOMIC LEVELS. J. Winter.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 375-7 (July 25, 1955). In French.

If the system is subjected to the action of several photons simultaneously two cases in particular arise: (i) $H_Z = 0$, $H_X \neq H_Y$, $\phi = \pi/2$, (ii) $H_X \neq H_Y \neq H_Z \neq 0$. Resonance takes place for $(2p + 1)\,\omega = \omega_0$ in (i), whereas in (ii) for $n\omega = \omega_0$ with n any integer. Both results retain conservation of energy and kinetic moment. J. Jacobs

539.153.4

568. REPLY TO TIETZ' LETTER: "APPROXIMATE ANALYTIC SOLUTION OF THE THOMAS–FERMI EQUATION FOR ATOMS". H.C.Brinkman.
J. chem. Phys., Vol. 23, No. 8, 1560 (Aug., 1955).

A note on the relative merits of Tietz's and the author's approximations (Abstr. 4762/1954 and 3008/1955). W.J.Swiatecki

539.153.4

569. REPLY TO BRINKMAN'S LETTER: CONCERNING MY LETTER "APPROXIMATE ANALYTIC SOLUTION OF THE THOMAS–FERMI EQUATION FOR ATOMS". T.Tietz
J. chem. Phys., Vol. 23, No. 8, 1560-1 (Aug., 1955).

See preceding abstract. The discussion includes a comparison of the accuracy of the solutions of $(1 + ax)^{-\alpha}$ for $\alpha = 1.0,\ 1.2,\ 1.3939$ (best), $1.4,\ 1.5,\ 1.6,\ 1.8,\ 2.0$. W.J.Swiatecki

539.153.4

570. NOTE ON THE ATOM FORM FACTOR CALCULATED FROM THE THOMAS–FERMI MODEL. T.Tietz.
J. chem. Phys., Vol. 23, No. 8, 1565 (Aug., 1955).

The form factor F(Z, K), where $K = (\sin\theta)/\lambda$, calculated using the approximate solution of the Thomas–Fermi equation given in Abstr. 3008 (1955), is compared with the results of Bragge and West (1929). W.J.Swiatecki

539.153.4

571. SYSTEMATIZATION OF THE APPROXIMATE SOLUTIONS OF THE THOMAS–FERMI EQUATION. K. Umeda and S. Kobayashi.
J. Phys. Soc. Japan, Vol. 10, No. 9, 749-52 (Sept., 1955).

Based on the generalized Brinkman remark that $x^{\sigma}\phi$ can be treated as a constant over the whole range of x, three homologues of the approximate T. F. solutions, i.e. (1) Brinkman, (2) Kerner–Tietz–Umeda and (3) Sommerfeld–March, are systematically established under either of two different guiding principles, the linearization of the T. F. equation in regard to ϕ and the elimination of the explicit x in the T. F. equation. A.

539.153.4

572. ACCURATE VALUE OF THE INITIAL SLOPE OF THE ORDINARY T.F. (THOMAS–FERMI) FUNCTION. S.Kobayashi, T.Matsukuma, S.Nagai and K.Umeda.
J. Phys. Soc. Japan, Vol. 10, No. 9, 759-62 (Sept., 1955).

By the inward numerical integration of the T.F. equation the accurate values of the initial slope as well as the asymptotic parameter of the ordinary T.F. function are ultimately determined as $B_0 = 1.5880710$ and $F_0 = 13.270934$, and the exact values of the function itself are tabulated. A.

539.153.4

573. SOME COEFFICIENTS OF THE SERIES EXPANSION OF THE TFD FUNCTION. S.Kobayashi.
J. Phys. Soc. Japan, Vol. 10, No. 9, 824-5 (Sept., 1955).

The twelfth to seventeenth coefficients of the expansion of the Thomas–Fermi–Dirac function in a semi-convergent power series about the origin are given. G.E.Brown

539.153.4

574. CORRELATION ENERGY OF HELIUM. H.Mitler.
Phys. Rev., Vol. 99, No. 6, 1835-6 (Sept. 15, 1955).

The correlation energy of helium is calculated by using an approximate central potential, in a manner analogous to Slater's calculation of the exchange energy. A

539.153.4

575. TEMPERATURE BEHAVIOUR OF THE THOMAS–FERMI STATISTICAL MODEL FOR ATOMS. R.Latter.
Phys. Rev., Vol. 99, No. 6, 1854-70 (Sept. 15, 1955).

The usual theoretical calculations of equations of state and specific heats, particularly at high temperatures and pressures, are dependent on the Thomas–Fermi statistical model of the atom. The mathematical description of this model involves complicated nonlinear differential equations, for which there have been an inadequate number of solutions available in the past. A number of solutions sufficiently extensive to determine the thermodynamic properties of all elements over an exceedingly wide range of temperatures and densities have been obtained with the aid of an IBM 701 Defense Calculator. The results are presented in graphical form. In addition, some of the analytic properties of the Thomas–Fermi equations have been investigated and certain approximate analytic solutions have been derived for limiting cases. A.

539.153.4

576. THE INTERPOLATION OF ATOMIC WAVE FUNCTIONS. D.R.Hartree.
Proc. Cambridge Phil. Soc., Vol. 51, Pt 4, 684-92 (Oct., 1955).

If r_{nl} is the mean radius for the radial wave function of a complete (nl) group in an atom of atomic number N, the variation of $1/r_{nl}$ with N is nearly linear. Further the variation of a given (nl) radial wave function with N is such that for a given value of (r/r_{nl}), the variation of the quantity $(r_{nl})^{\frac{1}{2}} P(nl; r)$ with r_{nl} is nearly linear. These relations between the radial wave functions for different atoms are examined from the point of view of using them as a means of interpolating, with respect to atomic number, between results for atoms for which solutions of Fock's equations have been carried out. A.

539.153.4

577. THE INTERPOLATION OF ATOMIC FIELDS. E.C.Ridley.
Proc. Cambridge Phil. Soc., Vol. 51, Pt 4, 693-701 (Oct., 1955).

Z(nl; r) is the contribution to Z(r) from an electron in the (nl) wave function. The Z(nl; r) vary systematically with atomic number and, as N becomes large, tend to the corresponding hydrogen-like functions, $Z_H(nl; r)$. A two-parameter method of fitting the Z(nl; r) to the $Z_H(nl; r)$ is described. This involves a 'screening constant' and a 'slope constant', both of which are defined. From published data, the two parameters have been obtained as functions of atomic number. The parameters for an unsolved atom can then be found by interpolation and approximate Z(nl; r) derived by appropriate adjustment of the functions for the nearest atom in the periodic table for which they are known. The method has been tested by interpolating for the (3d) function between Cu^+ and Rb^+ and by preparing estimates of the Z(nl; r) for the unknown structur Mo^+. The results were good for all but Z(4d; r) for Mo^+, where the number of values of the screening and slope constant already known was insufficient for reliable interpolation. A.

539.153.4

578. THE SELF-CONSISTENT FIELD FOR Mo^+. E.C.Ridley.
Proc. Cambridge Phil. Soc., Vol. 51, Pt 4, 702-6 (Oct., 1955).

The results of a self-consistent field calculation without exchange for Mo^+ are presented. A.

539.153.4 : 535.332

579. OSCILLATOR STRENGTHS FOR TRANSITIONS BETWEEN $2p^33p$ AND $2p^33s$ IN OXYGEN I, INCLUDING CONFIGURATION INTERACTION. R.F.Kingsbury.
Phys. Rev., Vol. 99, No. 6, 1846-50 (Sept. 15, 1955).

Oscillator strengths are calculated for transitions between the various terms of $2p^33p$ and $2p^33s$ of oxygen I. Term energies for the two configurations are calculated with the inclusion of the L(L + 1) correction of Trees and with configuration interaction. The configurations included with $2p^33s$ are $2p^34s$ and $2s2p^5$ while $2p^34p$ is included with $2p^33p$. It is shown that the L(L + 1) correction should be assigned to the parent ion. Configuration interaction is included in the calculation of σ^2 as well as in the energies. The radial wave functions used in the calculation of σ^2 are Hartree wavefunctions without exchange. A.

539.155.4

580. RELIABILITY OF ATOMIC MASSES IN THE CHROMIUM-GERMANIUM REGION. J. T. Kerr, J. G. V. Taylor and H. E. Duckworth.
Nature (London), Vol. 176, 458-9 (Sept. 3, 1955).

In this region of the periodic table 30 mass differences were obtained from mass spectroscopic and transmutation data, and the results from the two sources of information compared. For the stable isotopes of the same element the transmutation and mass-spectroscopic mass differences were reasonably consistent, but for different elements the situation was less satisfactory, particularly when the mass difference involved a nickel isotope. It is suggested that the masses of nickel isotopes determined mass-spectroscopically are too low by about 60×10^{-5} a.m.u. J. Hughes

RADIOACTIVITY. α-, β- AND γ-RAYS 539.16

539.16

5.. THE HISTORICAL ASPECT OF THE DISCOVERY (' ARTIFICIAL RADIOACTIVITY. S.Rosenblum.
J Phys. Radium, Vol. 16, No. 10, 743-7 (Oct., 1955). In l ench.

The discovery of artificial radioactivity by the Joliots is escribed and shown to be the foundation of nuclear physics d chemistry. J.Hughes

539.16

2. ARTIFICIAL RADIOACTIVITY AND CHEMISTRY.
A.Paneth.
Phys. Radium, Vol. 16, No. 10, 753-62 (Oct., 1955). In ench.

Discusses how the availability of radioactive isotopes of e elements has been used in chemistry, e.g. in the study of e rare earths and complicated organic transformations. H.Hughes

539.16

3. ARTIFICIAL RADIOACTIVITY AND BIOLOGY.
.Tubiana.
Phys. Radium, Vol. 16, No. 10, 763-9 (Oct., 1955). In ench.

Examples are given of the applications of radioactive isopes in biology, particular for the study of assimilation and sorption of various elements and the metabolism of organms. J.Hughes

539.16.08

4. THE FAST IONIZATION CHAMBER IN THE STUDY F α-RADIOACTIVITY IN AIR. U.Facchini and A.Malvicini.
uovo Cimento (Ser. 10), Vol. 2, No. 2, 340-3 (Aug., 1955).

Air to be examined is drawn through an electrical discharge made between sharp points and an Al plate; most of e radioactive contaminants are deposited on the plate, which then placed in an air-filled ionization chamber (see Abstr. 241/1955) and the alpha-particle energy spectrum is recorded th a pulse-height analyser. Activities down to 5×10^{13} c/m^3. an be measured. D.V.Mabbs

539.16.08 : 778.34

5. CONTRIBUTION TO THE STUDY OF THE RADIATION MITTED BY THE ACTIVE DEPOSIT OF THORIUM WITH THE ID OF PHOTOGRAPHIC EMULSIONS. M.Ader.
. Phys. Radium, Vol. 16, No. 8-9, 732-3 (Aug.-Sept., 1955).
n French.

See also Abstr. 10438 (1954). Measurements of ranges nd relative intensities of alpha-particle groups are reported. J.J.Wilkins

539.163

6. CONTRIBUTION TO THE STUDY OF ORBITAL LECTRON CAPTURE BY NUCLEI. APPLICATION TO Kr^{79}.
.Radvanyi.
nn. Phys. (Paris), Vol. 10, 584-642 (July-Aug., 1955). In rench.

Thesis. An experimental and theoretical discussion. 54 refs. A.O.Stanesby

539.163

7. EVIDENCE AGAINST THE EXISTENCE OF 3-HOUR V^{53}. R.K.Sheline, J.R.Wilkinson, B.J.Dropesky and .T.Shull.
hys. Rev., Vol. 99, No. 3, 1055 (Aug. 1, 1955).

Essentially no 23 hr vanadium was produced by bombarding enriched Cr^{53} with fast neutrons, by irradiating normal hromium in the Los Alamos Water Boiler, or by bombarding nriched Ti^{50} with 48 MeV alpha-particles. J.M.Cassels

539.163

588. RADIOACTIVITY OF THE CERIUM-137 ISOMERS.
A.R.Brosi and B.H.Ketelle.
Phys. Rev., Vol. 100, No. 1, 169-70 (Oct. 1, 1955).

A cerium isotope with an 8.7 hr half-life has been assigned to Ce^{137} and shown to decay by electron capture with about 3% of the captures to a 445 keV level in La^{137}. The 34.5 hr decay previously characterized as electron capture of Ce^{137} is an isomeric transition from a 255 keV level in Ce^{137}. Spin assignments consistent with the experimental data indicate that the transition between ground states of La^{137} and Ba^{137} should be allowed. However, the K or L electron capture half-life of La^{137} was found to be greater than 10^5 years. A.

539.163

589. DISTRIBUTION OF THE NUMBER OF PROMPT NEUTRONS FROM THE SPONTANEOUS FISSION OF Pu^{240}.
J.E.Hammel and J.F.Kephart.
Phys. Rev., Vol. 100, No. 1, 190-2 (Oct. 1, 1955).

A measurement of the distribution of the number of neutrons per fission of Pu^{240} yielded the following probabilities, P_m, for 0, 1, 2, etc. neutrons: $P_0 = 0.062$, $P_1 = 0.198$, $P_2 = 0.374$, $P_3 = 0.228$, $P_4 = 0.114$, $P_5 = 0.027$, $P_6 = 0.000$. The measurement was made with a liquid scintillation counter. A.

539.163 : 539.165

590. ELECTRON CAPTURE DECAY OF Am^{244} AND THE SPONTANEOUS FISSION HALF-LIFE OF Pu^{244}. P.R.Fields, J.E.Gindler, A.L.Harkness, M.H.Studier, J.R.Huizenga and A.M.Friedman.
Phys. Rev., Vol. 100, No. 1, 172-3 (Oct. 1, 1955).

The branching ratio (electron captures/beta-particles) of Am^{244} was determined as $0.039 \pm 0.003\%$. An enriched Pu^{244} sample was isolated from neutron-irradiated Am^{243}, and the spontaneous fission half-life of Pu^{244} was found to be $2.5 \pm 0.8 \times 10^{10}$ years. A.

539.163.1

591. THE HALF-LIFE OF YTTRIUM-90. E.V.Marathe.
J. sci. industr. Res., Vol. 14B, No. 7, 354-5 (July, 1955).

The decay of a source of Y^{90} eluted from Sr^{90} was followed over 14 half-lives and a value of 64.8 hr for the half-life obtained. M.A.Grace

539.163.1

592. UPPER LIMITS FOR THE LIFETIMES OF THE EXCITED STATES OF TITANIUM 46. R.E.Azuma.
Phil. Mag., Vol. 46, 1031-3 (Sept., 1955).

These were measured using a fast coincidence apparatus with a resolving time of about 2.5×10^{-9} sec. Both the excited states of Ti^{46} have lifetimes less than 5×10^{-11} sec. A.O.Stanesby

539.163.1

593. THE LIFETIME OF THE FIRST EXCITED STATE OF THALLIUM 203. R.E.Azuma and G.M.Lewis.
Phil. Mag., Vol. 46, 1034-6 (Sept., 1955).

This was measured by means of a fast coincidence unit (resolving time about 2×10^{-9} sec). A value of $(3 \pm 1) \times 10^{-10}$ sec was obtained. A.O.Stanesby

539.163.1

594. CONTRIBUTION TO THE STANDARDIZATION OF RADIOELEMENTS. PRECISE MEASUREMENTS OF RADIOACTIVE LIFETIMES. J.Tobailem.
Ann. Phys. (Paris), Vol. 10, 783-829 (Sept.-Oct., 1955). In French.

The lifetimes were measured with the help of a pair of ionization chambers connected differentially. Long lifetimes can be accurately measured in a time short compared to the lifetime. Typical results are the lifetimes of Co^{60} (5.27 ± 0.07 years, measured in 32 days), and of ThB (10.643 ± 0.012 hours, measured in $10\frac{1}{2}$ hours). J.M.Cassels

539.163.1

595 ELECTRIC QUADRUPOLE LIFETIMES IN EVEN-EVEN NUCLEI. C.F.Coleman.
Phil. Mag., Vol. 46, 1135-6 (Oct., 1955).

Beta–gamma coincidence methods have been used to obtain values or upper limits (about 10^{-8} to 10^{-11} sec) for the lifetimes of E2 gamma-ray transitions in ten nuclei from Mg^{24} to Cs^{131}. Lifetimes less than those estimated from the single particle model are indicated in some cases, providing evidence of collective nuclear motion. J.J.Wilkins

539.163.1

596. HALF-LIFE OF TRITIUM. W.M.Jones.
Phys. Rev., Vol. 100, No. 1, 124-5 (Oct. 1, 1955).

A value of 12.262 ± 0.004 years has been found for the tritium half-life by measurement of the He^3 growth in two samples. A.

539.163.1

597. NEW RADIOACTIVE ISOTOPE SCANDIUM-42. H.Morinaga.
Phys. Rev., Vol. 100, No. 1, 431-2 (Oct. 1, 1955).

A strong positron activity with a half-life of 0.62 ± 0.05 sec was obtained by irradiation of K metal by alpha-particles of energy about 18 MeV, and ascribed to Sc^{42}. A.O.Stanesby

539.163.1

598. 4.1 x 10^{-8} SECOND METASTABLE STATE IN Pa^{231}. D.Strominger and J.O.Rasmussen.
Phys. Rev., Vol. 100, No. 3, 844 (Nov. 1, 1955).

A metastable state of Pa^{231} with a half-life of (4.1 ± 0.4) x 10^{-8} sec has been observed. This half-life is exhibited by both 26 and 85 keV E1 gamma-transitions. A comparison is made with the metastable state in Pa^{233}. Upper limits on lifetimes are given for the E1 gamma-transitions in Np^{239} and Ac^{228}. The erratic variation in the lifetimes for E1 transitions is discussed. A.

539.163.1 : 778.34

599. ON A NEW METHOD FOR THE STUDY OF RADIOACTIVE PHENOMENA: CINE-NUCLEOGRAPHY. M.Laporte.
J. Phys. Radium, Vol. 16, No.8-9, 659-74 (Aug.-Sept., 1955). In French.

Describes a further application of the cine-nucleography method (Abstr. 8186/1955). It is shown how the period of ThC' may be determined by examining a nuclear emulsion which has been irradiated by a moving source of an active deposit of thorium. P.Rothwell

539.163.2

600. THE BRANCHING RATIO OF Kr^{85m} FROM FISSION YIELD STUDIES. A.T.Blades and H.G.Thode.
Z. Naturforsch, Vol. 10a, No. 11, 838-43 (1955).

The fission yield of the 85 mass chain has been determined both at Kr and Rb with a mass spectrometer using isotope dilution techniques. This has made possible a direct determination of the branching ratio of Kr which turns out to be 0.28. Thus 22% of the metastable isomer (Kr^{85m}) decays to Kr^{85} ground state. A.

539.163.2

601. INVESTIGATION INTO THE DECAY OF Co^{61} BY MEANS OF A SCINTILLATION SPECTROMETER. P. Erdös, P. Jordan, D. Maeder and P. Stoll.
Helv. phys. Acta, Vol. 28, No. 4, 323-5 (1955). In German.

Co^{61} produced by irradiating Cu^{63} in a 31.5 MeV betatron was chemically separated. The γ-spectrum was examined by means of a scintillation spectrometer; a line found at 72 ± 3 keV has a half-life of 1.75 ± 0.15 hr and is due to the $Co^{61} \rightarrow Ni^{61}$ decay. Measurements on the β-particles give the same result. A line found at 500 keV is thought to be due to the annihilation radiation from the β-decay of Cu^{64}. From shell-model considerations the 72 keV line is unlikely to be a isomer transition. It is thought to be due to a β-transition between the ground state of Co^{61} and an $f_{5/2}$ excited level in Ni^{61}. The Gamow-Teller selection rules allow an $f_{7/2}-f_{5/2}$ transition and the decay period is in agreement with this ($\log ft = 5.4$). The line is then a magnetic dipole transition ($f_{5/2}-p_{7/2}$). D.J. Prows

539.163.

602. A STUDY OF THE ISOTOPES 197 AND 195 OF GOLD AND MERCURY. R.Joly, J.Brunner, J.Halter and O.Huber. Helv. phys. Acta, Vol. 28, No. 4, 403-41 (1955). In French.

A detailed investigation of the complex gamma-ray spectra excited in the decay of the ground and isomeric states of Hg^{196} and Hg^{197} is fully described. The different modes of decay were disentangled using a coincidence arrangement of scintillation counters and a beta-spectrometer. Measurement of internal conversion coefficients and relative intensiti lead to the identification of the transitions and assignment of spins and parities to the levels which are similar in the two decay schemes. M.A.Grace

539.163.

603. ON THE DISINTEGRATION OF $_{64}Gd^{159}$. N.Marty. C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 385-7 (July 25, 1955). In French.

The β-, γ- and $\beta-\gamma$-coincidence spectra of the disinte gration were investigated. The β-spectrum has two components: $E_{\beta\,1\,max} = 948 \pm 10$ to the ground state of Tb^{159}. $E_{\beta\,2\,max} = 598 \pm 8$ keV (16%) followed by a feebly (α_K about 10^{-2}) converted γ-ray of 364 keV. The 56 keV γ-ray has an intensity of less than 10%. A disintegration scheme is pro posed. A.O.Stanesby

539.163.

604. RADIATIONS FROM LONG-LIVED $Tc^{(99)}$. S.Katcoff.
Phys. Rev., Vol. 99, No. 5, 1618-19 (Sept. 1, 1955),

A long-lived isotope of Tc was separated from Ru subjected to intense neutron irradiation in the Materials Testing Reactor; the half-life was about 10^4 yr and the isotope probably emits 300 keV beta-rays followed by 740 and 650 keV gamma-rays in cascade. A tentative mass assignment was made to Tc^{99}. A.O.Stanesby

539.163.

605. THE DECAY SCHEME OF ^{140} La. C.F.Coleman.
Phil. Mag., Vol. 46, 1132-4 (Oct., 1955).

Results of measurements on gamma-ray and gamma–gamma-coincidence spectra and on the gamma–gamma angula correlation, using NaI scintillation spectrometers. A consistent decay scheme is given. A.O.Stanesby

539.163.

606. DISINTEGRATION SCHEME OF Rb^{83}. M.L.Perlman and J.P.Welker.
Phys. Rev., Vol. 100, No. 1, 81-2 (Oct. 1, 1955).

The decay of Rb^{83} has been determined to proceed by electron capture to an excited state of Kr^{83} which is 0.566 MeV above the ground state. This excited state is depopulated exclusively by emission of a 0.525 MeV gamma ray (M1) to the 0.041 MeV state, Kr^{83m}. Little or no electron capture direct to the 0.041 MeV level or to lower levels occurs. The spin-parity designation of the 0.566 MeV state is $p_{3/2}$, and that of Rb^{83} ground state is $f_{5/2}$. A.

539.163.

607. RADIOACTIVE DECAY OF RUTHENIUM-97. J.M.Cork, M.K.Brice, L.C.Schmid and R.G.Helmer.
Phys. Rev., Vol. 100, No. 1, 188-90 (Oct. 1, 1955).

Ruthenium enriched in mass 96 was irradiated for short and long periods in the pile and the radioactivity of Ru^{97}, produced by neutron capture, was studied by magnetic and scintil

on spectrometers. Several gamma-rays not previously orted were found to exist. The observed gamma-rays in ^{97}, following K-capture in Ru^{97}, have energies of 109.1, 5.1, 325.1, and 570 keV. A long-lived metastable state in ^{97} decays by the emission of gamma-rays whose conversion ctrons indicate gamma energies of 90.2 and 99.2 keV. The ltipolarities of most of the transitions are determined and atisfactory nuclear level scheme is proposed. A.

539.163.2

3. DECAY OF Cr^{48}. R.van Lieshout, D.H.Greenberg, A.C.Koerts and C.S.Wu.
ys. Rev., Vol. 100, No. 1, 223-6 (Oct. 1, 1955).
The nuclide Cr^{48} has been produced by spallation of Ni. decays by electron capture only with a half life of 23 hours d emits gamma-rays of 116 keV (M1) and 305 keV (E2) of ual intensity, which are in coincidence. The genetic ationship with 16.2 day V^{48} establishes the mass assign-nt. The total decay energy of Cr^{48} can be estimated as 5 ± 0.20 MeV, two alternative decay schemes are proposed. A.

539.163.2

9. DISINTEGRATION SCHEMES OF THE Te^{127} AND ^{129} GROUND STATES. M.C.Day, Jr, G.W.Eakins and F.Voigt.
ys. Rev., Vol. 100, No. 3, 796-8 (Nov. 1, 1955).
A coincidence scintillation spectrometer was used to dy the decay of the 9.3 hour Te^{127} isomer and the 72 minute ^{129} isomer. The Te^{127} isomer was found to decay by a mple beta-ray with an end-point energy of 0.683 ± 0.010 MeV. e beta-ray spectrum of the Te^{129} isomer consists of two a groups with end-point energies of 1.46 ± 0.01 and 01 ± 0.02 MeV. Two gamma-rays with energies of 50 ± 0.005 and 0.035 MeV were observed, and they were nd to be in coincidence. The 0.450 MeV gamma-ray was own to be in coincidence with the 1.01 MeV beta-ray, and e 0.035 MeV gamma-ray was shown to be in coincidence h the 1.46 MeV beta-ray. The results are consistent with el assignments based on the shell model of the nucleus. A.

539.163.2

0. THE NEW ISOTOPES Cd^{104} AND Ag^{104}. F.A.Johnson.
nad. J. Phys., Vol. 33, No. 12, 841-55 (Dec., 1955).
Two new neutron-deficient isotopes Cd^{104} (59 min) and ^{104} (27 min) have been produced by the reaction Ag^{107}(p, 4n) ^{104} at 50 MeV in the McGill University synchrocyclotron and the subsequent growth of silver from the cadmium. These otopes have been investigated by means of a 180° spectro-aph of high resolution, a lens spectrometer, and a scintilla-n spectrometer. Chemical methods of identification have so been employed. Ag^{104} has been found to emit a positron ectrum of end point 2.70 ± 0.01 MeV and a gamma-ray of 6.2 keV which is thought to be in series with the positron ectrum. The origin of a gamma-ray of energy 118.4 keV ich appears to be converted in palladium is at present un-own. A tentative decay shceme is proposed. Cd^{104} appears decay primarily by K-capture since no positron spectrum s observed which could be assigned to this isotope. Four mma-rays, of energies 66.7, 83.6, 123.6 and 134.2 keV, ve been definitely assigned to this isotope on the basis of -L difference shown by conversion lines; on the basis of lative L line intensities and K/L ratios the two low-energy mma-rays have been shown to represent M1 transitions. her conversion lines were found whose origin and element conversion are unknown. A.

539.164

1. DIFFUSION CHAMBER OBSERVATION OF A SHORT-VED RADIOACTIVE GAS. J. J. Heilemann.
ier. J. Phys., Vol. 23, No. 6, 384 (Sept., 1955).

539.164 : 539.166

612. $\alpha - \gamma$ COINCIDENCES AND THE HALF-LIFE OF U^{235}. P.Huber, K.P.Meyer and E.Würger.
Helv. phys. Acta, Vol. 28, No. 4, 326-8 (1955). In German.
The analysis of natural samples of uranium depends on a knowledge of the half-life of U^{235}. This can be determined directly on a pure sample or on a sample of known isotopic composition. The most accurate determination in a pure sample is still limited by the U^{234} contamination. The two methods lead, within experimental error, to the same result of about 7.00×10^8 years. The fine structure decay scheme of U^{235} has been examined by observing the α-particles in coincidence with the γ-radiation. A 28% enriched sample was used. The energy scale was determined by the U^{234} and U^{238} lines in a natural isotope mixture. The chief line of U^{235} has been found not to lead directly to the ground state but to an excited state, the energy of the corresponding γ-ray being 180 keV. D.J.Prowse

539.164 : 539.166

613. COMPLEX ALPHA AND GAMMA SPECTRA OF $Cf^{250, 252}$. F.Asaro, F.S.Stephens, Jr, B.G.Harvey and I.Perlman.
Phys. Rev., Vol. 100, No. 1, 137-42 (Oct. 1, 1955).
The alpha and gamma spectra of Cf^{250} and Cf^{252} have been investigated with an alpha-particle spectrograph and an alpha-particle/gamma-ray coincidence counter. Alpha groups of 6.112 (84.5%) and 6.069 MeV (15.5%) belonging to Cf^{252} were found, as were groups of 6.024 (83%) and 5.980 MeV (17%), belonging to Cf^{250}. L X-rays and gamma-rays of 42 (0.014%) and 100 keV (0.01_3%) were assigned to Cf^{252}. Other gamma-rays were assigned to odd-mass californium isotopes. The results are evaluated with respect to the current theory and systematics of complex alpha spectra and excited states of even-even nuclei. A.

539.164.2 : 539.153.4

614. THEORY OF ATOMIC PERTURBATION IN ALPHA DECAY. H.M.Schwartz.
Phys. Rev., Vol. 100, No. 1, 135-7 (Oct. 1, 1955).
A method for calculating the probabilities of internal atomic excitation in alpha decay is outlined and compared with earlier work by other authors. A.

539.165

615. EXPERIMENTAL STUDY OF THE DOUBLE BETA-RADIOACTIVITY OF Cd^{116}. J.-F. Detoeuf and R. Moch.
C. R. Acad. Sci. (Paris), Vol. 241, No. 4, 393-5 (July 25, 1955). In French.
A minimum mean lifetime of 6×10^{16} years was set for the double beta-decay of Cd^{116} without neutrino emission. The pulses in two scintillation counters near a thin source of Cd^{116} were added electronically, a source of Cd^{114} being used as a control. The experimental result, which compares with a rough theoretical estimate of 2×10^{16} years, does not rule out the possibility of this type of decay. J. M. Cassels

539.165

616. ROTATIONAL LEVELS IN THE BETA DECAY OF PROTACTINIUM ISOTOPES. Ong Ping Hok.
Phys. Rev., Vol. 99, No. 5, 1613-14 (Sept. 1, 1955).
Indications of rotational levels in the even-even daughter nuclides (U or Th) were found. G.E.Brown

539.165

617. K-CAPTURE – POSITRON RATIOS FOR THE FIRST-FORBIDDEN TRANSITIONS OF Rb^{84} AND THE RELATIVE PROBABILITIES OF L- AND K- ELECTRON CAPTURE. J.P.Welker and M.L.Perlman.
Phys. Rev., Vol. 100, No. 1, 74-80 (Oct. 1, 1955).
The radiations from Rb^{84} have been investigated by means of scintillation coincidence spectrometer techniques in order to obtain the relative intensities of the various transitions.

The energies and abundances of the radiations are 0.44 MeV β^- (5%), 0.81 MeV β^+ (10%), 1.70 MeV β^+ (9%), 0.89 MeV γ (64%), and 1.91 MeV γ (0.9%). Electron capture populates the level 1.91 MeV above the ground state, competes (54%) with the 0.81 MeV β^+ to populate the level 0.89 MeV above ground, and competes (21%) with the 1.70 MeV β^+ in effecting transitions to the ground state of Kr^{84}. The ratios of K-capture to positron emission for the transition to the 0.89 MeV level ($\Delta I = 0$, yes) and to the Kr^{84} ground state ($\Delta I = 2$, yes) are 5.15 ± 0.38 and 2.06 ± 0.36, respectively. These values are in qualitative agreement with theory. Nucleon configurations of the several states of Rb^{84}, Kr^{84} and Sr^{84} are discussed. In the decay to the 0.89 MeV level an L/K-capture ratio of 0.12 ± 0.05 was obtained by use of a value, 0.65, for the fluorescence yield of krypton. Alternatively, an experimental value for the fluorescence yield, 0.62 ± 0.03, may be computed if the theoretical L/K-capture ratio is assumed. A.

539.165

618. DOUBLE K CAPTURE AND SINGLE K CAPTURE WITH POSITRON EMISSION. R.G.Winter.
Phys. Rev., Vol. 100, No. 1, 142-4 (Oct. 1, 1955).

Transition probabilities are estimated for double K capture and for single capture with single positron emission. With real neutrino emission, the mean lives for both processes should be greater than 10^{24} years. Without real neutrino emission, as with Majorana neutrinos, the mean life for K capture in conjunction with positron emission is about 10^{15} years in the allowed approximation. Double K capture, however, is then at least a third-order process because an additional step is necessary to remove the energy, with the result that the mean life exceeds 10^{18} years. A.

539.165.08

619. AN ARRANGEMENT FOR THE QUANTITATIVE DETERMINATION OF WEAK β-RAY EMITTERS WITH FLUORESCENT SOLUTIONS. J.C.Roucayrol and E.Oberhausen.
Naturwissenschaften, Vol. 42, No. 14, 411-12 (1955). In German.

The radioactive substance and fluorescent solution are contained in a cell of 10 ml capacity having a quartz window mounted in good optical contact above the photocathode of a photomultiplier (E.M.I. 6262) which is water-cooled. Best results are obtained with a solution of 10 mg/l phenyldiphenyloxadiazol in toluene. A diagram of the apparatus is given.
D.V.Mabbs

539.165.2

620. HOW TO FIGURE THE SHAPES OF BETA-RAY SPECTRA. J.H.Marshall.
Nucleonics, Vol. 13, No. 8, 34-8 (Aug., 1955).

Graphs of functions for calculating beta-ray energy distributions in allowed and first-forbidden ($\Delta I = 2$) transitions, zero-energy ordinates of allowed spectra and average energies of allowed negatron spectra, are given. Some specimen allowed negatron and positron spectra for various Z and E_0 are illustrated. L.R.Shepherd

539.166

621. THE ENERGETIC PART OF THE GAMMA-RAY SPECTRUM OF ThD DETERMINED WITH THE AID OF A DIFFUSION CLOUD CHAMBER. S.Wiktor.
Bull. Acad. Polon.Sci. Cl. 3, Vol. 3, No. 6, 321-4 (1955).

Photo-neutrons from a MsTh–Be source were studied by observation of proton recoils in the cloud chamber. The results indicate 3.20 and 2.62 MeV gamma-rays having intensities in the ratio 1 : 12. J.J.Wilkins

539.166

622. GAMMA-GAMMA ANGULAR CORRELATION IN Ba^{134}. E.D.Klema.
Phys. Rev., Vol. 100, No. 1, 66-8 (Oct. 1, 1955).

The directional angular correlation of the 1367-605 keV gamma-gamma cascade in Ba^{134} has been measured with a coincidence scintillation spectrometer using NaI detectors. For a dilute caesium chloride aqueous solution source, the observed correlation function, after correcting for the finite angular resolution of the detectors, is given by $W(\theta) = 1 + (0.090 \pm 0.0086)P_2(\cos\theta) - (0.004 \pm 0.013)P_4(\cos\theta)$. From this result it is not possible to assign unambiguously a spin and parity to the 1972 keV level in Ba^{134}, from which the cascade originates. However, the present angular correlation data taken with internal conversion coefficient data for the transitions from this level indicate that it very probably has spin 3 and odd parity. A.

539.166

623. GAMMA RAYS EXCITED BY INELASTIC SCATTERING OF NEUTRONS IN VARIOUS ELEMENTS. M.A.Rothman, H.S.Hans and C.E.Mandeville.
Phys. Rev., Vol. 100, No. 1, 83-4 (Oct. 1, 1955).

Neutrons of energy 3.7 MeV have been inelastically scattered in a number of elements. The energies of the gamma-rays so excited have been measured by scintillation counting and pulse height analysis. In some cases, the cross-sections for gamma-ray excitation have been calculated. A.

539.166

624. GAMMA-RAY BRANCHING IN Sr^{89}. W.S.Lyon and R.R.Rickard.
Phys. Rev., Vol. 100, No. 1, 112 (Oct. 1, 1955).

The decay of Sr^{89} has been found to proceed through Y^{89m} to the extent of 0.02%. A.

539.166

625. INNER BREMSSTRAHLUNG FROM A^{37}. T.Lindqvist and C.-S.Wu.
Phys. Rev., Vol. 100, No. 1, 145-9 (Oct. 1, 1955).

The continuous gamma-ray spectrum (inner bremsstrahlung), accompanying orbital electron capture in A^{37}, has been reinvestigated by the method of scintillation spectroscopy with particular emphasis on the low energy region. The absorption between the source and the NaI crystal is only due to two one-mil Al foils. After correcting for NaI crystal detection efficiency, the geometrical factor, the ratio of photoelectric cross-section to total cross-section, Compton electron backscattering, iodine X-ray escape, absorption and resolution, it is found that the intensity of the extremely low-energy photons is much greater than can be accounted for by Morrison and Schiff's treatment. A better agreement can be obtained if one considers the p-electron capture, and takes the Coulomb effect into consideration as shown by Glauber and Martin. A.

539.166

626. PRECISION ENERGY MEASUREMENTS OF THE GAMMA RAYS FOLLOWING THE DECAY OF Bi^{207}. A.I.Yavin and F.H.Schmidt.
Phys. Rev., Vol. 100, No. 1, 171-2 (Oct. 1, 1955).

The external conversion spectrum of the two intense gamma-rays of Pb^{207} has been examined by means of a high-resolution spectrometer. The 1.06 MeV gamma-ray was found to consist of a single component of energy 1063 ± 0.50 keV. The energy of the ground-state transition was found to be 568.85 ± 0.30 keV. A.

539.166

627. ANGULAR DISTRIBUTION OF GAMMA RAYS IN COULOMB EXCITATION. G.Breit, M.E.Ebel and F.D.Benedict.
Phys. Rev., Vol. 100, No. 1, 429 (Oct. 1, 1955).

Reported discrepancies (Abstr. 8214/1955) between theory and experiment have been removed by improvements of the theory. The nature of these improvements is indicated briefly, and numerical results for Pt^{194} (330 keV level) are given.
J.J.Wilkins

539.166 : 539.172.13

628. GAMMA RAYS FROM THE DEUTERON BOMBARDMENT OF Al^{27} AND P^{31}. R.D.Bent, T.W.Bonner, J.H.McCrary and W.A.Ranken.
Phys. Rev., Vol. 100, No. 3, 774-6 (Nov. 1, 1955).

A magnetic-lens pair spectrometer has been used to study the radiations produced by the bombardment of Al^{27} and P^{31} with 4.6 MeV deuterons from a Van de Graaff accelerator. Gamma-rays from the bombardment of Al^{27} were observed at 6.9 ± 0.1, 7.38 ± 0.06, 7.55 ± 0.06, 7.91 ± 0.04, 8.28 ± 0.04, 8.75 ± 0.04, 9.08 ± 0.04, 9.45 ± 0.08, 9.87 ± 0.08 and 10.7 ± 0.2 MeV. Gamma-rays from the bombardment of P^{31} were observed at 4.41 ± 0.04, 4.71 ± 0.04, 4.94 ± 0.04, 5.29 ± 0.04, 5.79 ± 0.04, 6.11 ± 0.04, 6.84 ± 0.04, 7.46 ± 0.08, 8.16 ± 0.04 and 8.53 ± 0.04 MeV. All energies are Doppler-corrected. A.

539.166.7

629. CIRCULAR POLARIZATION OF GAMMA-RAYS FOLLOWING POLARIZED NEUTRON CAPTURE. G.Trumpy.
Nature (London), Vol. 176, 507 (Sept. 10, 1955).

Thermal neutrons, polarized by transmission through magnetized iron, fell on the (n, γ) target and the γ-rays were detected by NaI(Tl) crystals after passing through analysers of iron magnetized in the direction of transmission. From the measurements, only the sign of $|P_n|.P_r$ could be given with certainty (P_n and P_r are the neutron and γ-ray polarizations respectively). In the simple cases investigated, this was sufficient information to enable some of the constants of the reactions to be derived. J.Hughes

539.166.75

630. SOME MONTE CARLO CALCULATIONS OF GAMMA-RAY PENETRATIONS. J.F.Perkins.
J. appl. Phys., Vol. 26, No. 11, 1372-7 (Nov., 1955).

The transmission of gamma-rays through slabs of various shielding materials has been calculated by a random sampling method in which the path lengths between interactions are deliberately chosen larger than those which occur naturally. Results for the case of normal incidence compare reasonably with values obtained by Goldstein and Wilkins for transmission in infinite media. The present results for the case of obliquely incident photons show the same general behaviour as noted experimentally by Kirn, et al. In particular, the transmission plotted against slant path length shows a crossover, in the region of 1 or 2 mean free paths, of the curves corresponding to different incident angles. Angular and spectral distributions were obtained in the form of histograms, and it was found that the photons assume spatial equilibrium after one or two mean free paths, as evidenced by the constancy of the flux-to-current ratio. The relative contribution to the total penetration arising from the first, second, etc. scattering has been found to have the same general trend as noted earlier by Peebles. The biased sampling method which was used enables one to use the same set of photon case histories in treating a number of slab thicknesses. A.

539.166.83

631. MULTIPLE ELECTRON EXCITATION IN AUGER PROCESSES. M.Wolfsberg and M.L.Perlman.
Phys. Rev., Vol. 99, No. 6, 1833-5 (Sept. 15, 1955).

Consideration of the Auger effect as a polyelectron phenomenon leads to the expectation of an accumulation of a greater charge on an atom, as the result of an Auger cascade, than that obtainable by the conventional two-electron theory. On this basis, calculations are made of the probability for the accumulation of large charges by chlorine atoms originally possessing a K vacancy. The theoretical results correlate well with the recent experimental measurements of the charge distribution of the chlorine atoms produced by the electron-capture decay of argon 37. A.

539.166.83

632. FLUORESCENCE YIELDS OF THE L LEVELS OF Bi. M.A.S.Ross, A.J.Cochran, J.Hughes and N.Feather.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 942 (Oct., 1955).

See Abstr. 8224 (1955). Discusses the effect of using an improved value for the conversion coefficient of M1 radiation in the L_{III} shell in which an allowance for screening is now made. J.Hughes

539.166.83

633. SPECTRUM OF INTERNAL BREMSSTRAHLUNG FROM Cr^{51}. S.G.Cohen and S.Ofer.
Phys. Rev., Vol. 100, No. 3, 856-8 (Nov. 1, 1955).

Under favourable circumstances the spectrum of internal bremsstrahlung can be detected from K-capture isotopes decaying with the emission of gamma-rays. The high-energy part of the ground to ground internal bremsstrahlung spectrum can be detected in Cr^{51}, in the presence of 320 keV gamma-rays, if suitable precautions to minimize the random superposition of small pulses are taken. A value of 780 ± 50 keV has been found for the energy of disintegration. By using the theoretical expression of Morrison and Schiff for the intensity of the internal bremsstrahlung spectrum, a value of 7% was obtained for the percentage of disintegrations decaying to the 320 keV level of V^{51}. The results are in good agreement with measurements by independent methods. A.

539.166.835

634. ANGULAR CORRELATION OF SCATTERED ANNIHILATION RADIATION. G.Bertolini, M.Bettoni and E.Lazzarini.
Nuovo Cimento (Ser. 10), Vol. 2, No. 3, 661-2 (Sept., 1955).

An attempt has been made to find a correlation between the polarization planes of two quanta emitted in the annihilation of a positron-electron pair. According to pair theory, with zero angular relative momentum these planes should be at right angles. A Na^{22} source placed in a lead block produced annihilation radiation which was collimated by two conical channels. This radiation was scattered from aluminium and the scattered Compton quanta were detected by NaI(Tl) crystals. The coincidence rates were then measured. The ratio of the coincidence counts when the detectors are at right angles and when they are coplanar has been calculated from the geometry, assuming correlation to be 2.32; the experimental result of 2.18 ± 0.09 is in good agreement with this. D.J.Prowse

539.166.835

635. ANGULAR CORRELATION OF THE PAIR ELECTRONS FROM THE MONOPOLE TRANSITION OF O^{16} (6.05 MeV); ENERGY SPECTRUM OF THESE PAIRS.
S. Gorodetzky, R. Armbruster, P. Chevallier, A. Gallmann and R. Manquenouille.
C. R. Acad. Sci. (Paris), Vol. 241, No. 11, 698-700 (Sept. 12, 1955). In French.

Results of coincidence spectrometer measurements are reported, and shown to be in good agreement with theory. J. J. Wilkins

539.166.835

636. ANNIHILATION OF POSITRONS IN CONDENSED MATERIALS. P.R.Wallace.
Phys. Rev., Vol. 100, No. 2, 738-41 (Oct. 15, 1955).

An analysis of the experimental results is suggested, differing from that recently published by Dixon and Trainor. Considerations are offered which make it seem unlikely that excited states of positronium play a significant role. The long lifetime in molecular materials is explained in terms of the formation of 1s triplet positronium, while the short lifetime in these materials is interpreted as having a complex origin. The frequency of three-quantum annihilation, the temperature effect of the long lifetime, the angular correlation of the gamma rays, and annihilation in superconductors are discussed. A.

NUCLEAR REACTIONS 539.17

539.172

NUCLEAR REACTIONS DUE TO COSMIC RAYS.

See also under "Cosmic rays". Decimal classification 537.591.8

539.172

637. THE INTERACTION OF NEGATIVE π-MESONS WITH NUCLEI OF BERYLLIUM, CARBON AND OXYGEN IN THE ENERGY RANGE FROM 140 TO 400 MeV. A.E.Ignatenko, A.I.Mukhin, E.B.Ozerov and B.M.Pontekorvo (Pontecorvo). Dokl. Akad. Nauk SSSR, Vol. 103, No. 3, 395-7 (1955). In Russian.

Gives the results of an investigation of the energy dependence of total cross-sections for the interaction of π^--mesons with these three elements. Scintillation counters were used to measure the attenuation of a π^--meson beam, with the arrangement described in a previous paper (Abstr. 9141/1953). The measured cross-sections were corrected for μ^--meson admixture, chance coincidences, miscounting, small-angle scattering and secondary particles, and the results are tabulated together with the corresponding errors. The total cross-section is found to have a flat maximum from 140 to 230 MeV, decreasing sharply on each side of this range. J.B.Sykes

539.172

638. TOTAL CROSS SECTION OF HYDROGEN FOR 150- TO 750-MeV POSITIVE AND NEGATIVE PIONS. S.J.Lindenbaum and L.C.L.Yuan
Phys. Rev., Vol. 100, No. 1, 306-23 (Oct. 1, 1955).

The total cross-section has been determined. An early preliminary survey using polyethylene-carbon differences is reported and indicated a resonance in the state of isotopic spin and angular momentum equal to $3/2$ (i.e., $T = J = 3/2$). A more recent precision determination (about 3-5%) of the total hydrogen cross-section for positive pions in the presumed resonance region (140-340 MeV) has been performed using liquid hydrogen transmission measurements. A theoretical analysis of the results in conjunction with other available data strongly supports the hypothesis of a resonance. The behaviour of the phase shift of the $T = J = 3/2$ state is deduced and given. The most probable solution for the phase shift in this state is found to pass through 90° at about 175-180 MeV, although although one cannot completely rule out the possibility of the resonance (90° phase shift) occurring up to 200 MeV. The $T = 1/2$ state cross-section is found to be zero within the errors in the resonance region and to become appreciable only above 300 MeV. The present experimental data and other relevant work is analysed in terms of the recent Chew–Low theory and the Brueckner phenomenological resonance theory and is found to fit the general behaviour predicted by both, which incidentally is shown to be of similar form. A.

539.172.11/.13

639. HEAVY PARTICLE STRIPPING. L.Madansky and G.E.Owen.
Phys. Rev., Vol. 99, No. 5, 1608-9 (Sept. 1, 1955).

It is suggested that the target nucleus, in such reactions as $Be^9(\alpha, n)C^{12}$ and $B^{11}(d, n)C^{12}$, consists of a tightly bound core plus a neutron in a p state. The core is captured by the bombarding particle and the neutron escapes, preferentially backwards in the laboratory frame. The experimental angular distribution of the $B^{11}(d, n)C^{12}$ reaction shows such a backward peak. J.M.Cassels

539.172.11

640. ELASTIC SCATTERING OF 19-MeV ALPHA PARTICLES BY Al AND Cu. E.Bleuler and D.J.Tendam.
Phys. Rev., Vol. 99, No. 5, 1605-6 (Sept. 1, 1955).

Cu is similar to heavy elements, the ratio σ/σ_R (where σ_R is the Rutherford cross-section) showing a monotonic decrease with increasing scattering angle, although there are indications of diffraction effects at large angles. For Al the behaviour is quite different, showing a diffraction pattern similar to that observed in the elastic scattering of protons. J.Hughes

529.172.11

641. ELASTIC SCATTERING OF 40-MeV ALPHA PARTICLES FROM Al. R.M.Eisberg, G.Igo and H.E.Wegner.
Phys. Rev., Vol. 99, No. 5, 1606 (Sept. 1, 1955).

The angular distribution shows a pronounced diffraction pattern similar to that observed in the scattering of 19-MeV alpha-particles by Al (see preceding abstract). J.Hughes

539.172.11

642. SCATTERING OF 22-MeV α PARTICLES BY C^{12}. V.K.Rasmussen, D.W.Miller and M.B.Sampson.
Phys. Rev., Vol. 100, No. 1, 181-7 (Oct. 1, 1955).

The elastic and inelastic scattering has been observed at a number of angles. Groups corresponding to the excitation of C^{12} to the known 4.4, 7.7 and 9.6 MeV levels were found. There was no evidence for the higher states reported by others except possibly at about 12.7 MeV excitation. A strong angular dependence and a marked lack of symmetry around 90° was observed. The excitation function for $E_\alpha = 20.4$ to 22.6 MeV indicates a resonance at $E_\alpha = 21.85 \pm 0.1$ MeV, and the angular asymmetry indicates that there is at least one other level of opposite parity in this region. The Q-value for the second excited state was measured to be -7.64 ± 0.07 MeV. By looking for the appropriate C^{12} recoil ions it was established that this state decays to $Be^8 + \alpha$ with more than 80% probability. A.

539.172.13

643. THE FISSION OF URANIUM NUCLEI BY PROTONS OF ENERGY 460 MeV. N.S.Ivanova, N.A.Perfilov and V.P.Shamov.
Dokl. Akad. Nauk SSSR, Vol. 103, No. 4, 573-5 (1955). In Russian.

Photographic emulsion plates loaded with uranium were irradiated by protons of energy 460 MeV. In an electron-sensitive emulsion, 46 fissions were found, of which 83% were accompanied by the emission of light charged particles (up to six in number, with an average of 1.65). In another emulsion with a proton-sensitivity limit of about 80 MeV, 102 fissions were found with an average of 1 particle emitted. Thus 40% of the particles have energies greater than 80 MeV. The angular distribution of these particles was predominantly forward. It is concluded that the majority of the particles originate in a nuclear cascade process in the uranium nucleus. Upper and lower limits to the mean excitation energy are roughly estimated to be 198 and 128 MeV respectively. The fission cross-section was found to be 1.2 ± 0.3 barn, so that about 70 ± 18% of uranium nuclei undergo fission on interacting with 460 MeV protons. The mean total path of the fission fragments is found to be the same as for fission by π-mesons and by slow neutrons. The kinetic energy of the fragments is therefore derived only from their Coulomb repulsion. J.B.Sykes

539.172.13

644. MECHANISM OF THE FISSION OF HEAVY NUCLEI AT HIGH EXCITATION ENERGIES. V.P.Shamov.
Dokl. Akad. Nauk SSSR, Vol. 103, No. 4, 593-5 (1955). In Russian.

Nuclear photographic plates with a proton-sensitivity limit of about 30 MeV were loaded with uranium, bismuth or tungsten and irradiated by protons of 460 MeV and 660 MeV. For each energy, the mean number of charged particles, the ratio of alpha-particles to protons, the mean excitation energy and the fission cross-section are tabulated for each of the three elements. The alpha-particles are emitted isotropically, while the majority of the protons are directed forwards. A comparison of spectra shows that all the alpha-particles and

about 70% of the protons are evaporated. The number of charged particles emitted is tabulated as a function of the initial excitation energy, showing a one-to-one correspondence. The mechanism of the fission process is analysed for each of the three elements investigated. It is found that fission occurs only after the nucleus has cooled by evaporating neutral and charged particles. J.B.Sykes

539.172.13

645. EXCITATION STUDIES OF REACTIONS OCCURRING IN THE PROTON BOMBARDMENT OF ^{10}B. J. W. G. Wignall.
Austral. J. Phys., Vol. 8, No. 2, 310-14 (June, 1955).

The excitation functions for $B^{10}(p, \alpha)Be^{7}$ and $B^{10}(p, \gamma)C^{11}$ were studied by assaying the Be^{7} and C^{11}. Both rise smoothly up to 750 keV proton energy. M. A. Grace

539.172.13

646. ELASTIC SCATTERING OF 5.25 MeV PROTONS ON NICKEL AND COPPER. D.A.Bromley and N.S.Wall.
Phys. Rev., Vol. 99, No. 3, 1029-30 (Aug. 1, 1955).

The experimental results, when compared with each other and with other data at 6.0 MeV, do not show the smooth evolution with energy and atomic number which would be expected on the complex potential model. J.M.Cassels

539.172.13

647. GAMMA-RAY AND NEUTRON YIELDS FROM THE PROTON BOMBARDMENT OF BORON. J.K.Bair, J.D.Kington and H.B.Willard.
Phys. Rev., Vol. 100, No. 1, 21-4 (Oct. 1, 1955).

Yield curves of the gamma-rays and neutrons resulting from the proton bombardment of boron have been measured for proton energies from approximately 2 to 5 MeV. Both the 0° and 90° yields for the $B^{11}(p, \gamma)C^{12}$ reaction have been measured for the ground state transition and for the transition to the 4.43 MeV state in C^{12}, as has the yield of the 2.14 MeV γ-ray resulting from the inelastic scattering of protons on B^{11}. The neutron yield from $B^{11}(p, n)C^{11}$ is given at 0° and for almost 2π solid angle in the forward direction. New levels were observed in the C^{12} compound nucleus at 18.3. 18.39, 18.84, 19.2, 19.41, 19.66, 19.87, 20.25, 20.48 and 20.64 MeV. Preliminary data are given for the $B^{10}(p, n)C^{10}$ and $B^{10}(p, \gamma)C^{11}$ reactions. A.

539.172.13

648. STUDY OF THE NUCLEAR REACTIONS $Sc^{45}(p, n)Ti^{45}$, $Cu^{63}(p, n)Zn^{63}$, $Cu^{65}(p, n)Zn^{65}$ and Zn(p, n)Ga. R.M.Brugger, T.W.Bonner and J.B.Marion.
Phys. Rev., Vol. 100, No. 1, 89-90 (Oct. 1, 1955).

The counter ratio method has been applied to these reaction to determine the Q values for the ground state thresholds and to locate low-lying states in the residual nuclei. The thresholds for the (p, n) reactions were found to be 2.908 MeV for Sc^{45}, 4.215 MeV for Cu^{63}, 2.169 MeV for Cu^{65} and 3.749 MeV for Zn^{68}. Other neutron thresholds were found corresponding to excited states in Ti^{45} at 0.743, 1.194, 1.347, 1.460, 1.876, 2.016, 2.430 and 2.555 MeV; in Zn^{63} at 0.191, 0.642 and 1.043 MeV; and in Zn^{65} at 0.78, 1.26 and 1.93 MeV. A threshold was found in the Zn(p, n)Ga reaction which is probaly due to a level in Ga^{68} at 0.170 MeV. Cross-sections for the yield of neutrons in the forward direction were determined. The yields of neutrons from thin Sc^{45} and Cu^{63} targets were obtained for the proton energy region from the thresholds to 70 keV above these thresholds. McKibben nomographs are given for these two reactions. A.

539.172.13

649. STUDY OF THE REACTIONS $T^{3}(p, n)He^{3}$, $Li^{7}(p, n)Be^{7}$, $Be^{9}(p, n)B^{9}$ and $F^{19}(p, n)Ne^{19}$. J.B.Marion, T.W.Bonner and C.F.Cook.
Phys. Rev., Vol. 100, No. 1, 91-6 (Oct. 1, 1955).

A counter ratio study has been made of these reactions. The ground state threshold energy for the reaction $F^{19}(p, n)Ne^{19}$ was found to be 4.235 ± 0.005 MeV. Other neutron thresholds were observed which indicated excited states in $*Be^{7}$ at 0.434 ± 0.004 MeV, in $*B^{9}$ at 2.326 ± 0.006 MeV and in $*Ne^{19}$ at 0.241 ± 0.004 and 0.280 ± 0.004 MeV. A broad maximum in the yield of slow neutrons from the bombardment of Be^{9} was observed which could be due to the three-body breakup, $Be^{9}(p, pn)Be^{8}$, or to a broad, even-parity state in B^{9} at 1.4 MeV. The cross-sections for the reactions $Be^{9}(p, n)B^{9}$, $B^{11}(p, n)C^{11}$, $C^{13}(p, n)N^{13}$ and $F^{19}(p, n)Ne^{19}$ were measured. A.

539.172.13

650. MAGNETIC ANALYSIS OF THE $Be^{9}(p, p')*Be^{9}$ AND $Be^{9}(p, pn)Be^{8}$ REACTIONS. C.R.Gossett, G.C.Phillips, J.P.Schiffer and P.M.Windham.
Phys. Rev., Vol. 100, No. 1, 203-6 (Oct. 1, 1955).

The energy distribution of protons from the bombardment of Be^{9} with protons has been investigated by precision magnetic analysis in the region of excitation from the ground state through the 2.43 MeV state. A broad distribution of protons was found with a cutoff corresponding to a Q of -1.675 ± 0.002 MeV in Be^{9}. The asymmetry of the observed group and the proximity of the observed Q-value to the separation energy of a neutron from Be^{9} suggests that the group consists of protons from the three-body disintegration $*B^{10} \rightarrow Be^{8} + p + n$, but the possibility of inelastic scattering to a state in Be^{9} cannot be excluded. An excitation energy of 2.432 ± 0.004 MeV was found for the inelastic proton group from the known state, and a natural width not more than 1 keV is ascribed to this state from experiments conducted at optimum resolution. A.

539.172.13

651. (p, γ) CROSS SECTIONS. B.L.Cohen
Phys. Rev., Vol. 100, No. 1, 206-8 (Oct. 1, 1955).

Several (p, γ) cross-sections were measured by activation with protons from 8 to 22 MeV. The dependences on incident energy and target mass are very slight, whereas a compound nucleus model would predict variations by many orders of magnitude. It seems probable, therefore, that the observed reactions are due to high-energy gamma transitions taking place prior to compound nucleus formation. The magnitudes involved indicate that these transitions have single-particle dipole matrix elements. A.

539.172.13

652. PRODUCTION OF MONOENERGIC d–d NEUTRONS WITH THE AID OF n-He^{3} COINCIDENCES. W.Franzen, P.Huber and L.Schellenberg.
Helv. phys. Acta, Vol. 28, No. 4, 328-31 (1955). In German.

n-He^{3} coincidences (resolving time about 10^{-7} sec) were detected and can be used to gate other circuits. The energy resolution was about 10 keV. A.O.Stanesby

539.172.13

653. THE MATRIX FORMULATION OF (d, p) INTERACTIONS. O.Hittmair.
Z. Phys., Vol. 142, No. 2, 219-24 (1955). In German.

The exact formulation of the (d, p) cross-section in terms of the matrix elements of the interaction experienced by the outgoing proton, clarifies the effects of various approximations — in particular the Butler theory and simple Born approximation — which lead to explicit solutions. P.T.Matthews

539.172.13

654. NEUTRONS EMITTED IN THE DEUTERON BOMBARDMENT OF CARBON. J. R. Bird.
Austral. J. Phys., Vol. 8, No. 2, 314-18 (June, 1955).

Neutron groups from the reaction $C^{13}(d, n)N^{14}$ were detected in nuclear emulsions using a thick target and a beam energy of 0.92 MeV. These groups correspond to levels in N^{14} at 2.30, 3.95 and 4.95 MeV. Angular distributions were measured. M. A. Grace

539.172.13

655. BREAK-UP OF DEUTERONS ON H, T, He^3 and He^4. R.L.Henkel, J.E.Perry, Jr and R.K.Smith.
Phys. Rev., Vol. 99, No. 3, 1050-2 (Aug. 1, 1955).

For deuteron bombarding energies above 3.5 MeV the high-energy neutrons from the T(d, n)He^4 reaction are contaminated by low-energy neutrons, probably from the T(d, pn)T reaction. Similar low-energy neutrons appear in three other light nuclear reactions when the deuteron binding energy is available. The absence of the D(d, pn)D reaction is attributed to an isobaric spin selection rule, which forbids the formation of the proton and neutron in the ^1S state. J.M.Cassels

539.172.13

656. REACTIONS $C^{12}(d, n)N^{13}$ ground state AND $C^{12}(d, t)C^{11}$ UP TO E_d = 20 MeV. D.H.Wilkinson.
Phys. Rev., Vol. 100, No. 1, 32-6 (Oct. 1, 1955).

The course of the partial cross-section for the direct formation of N^{13} in its ground state only in the reaction $C^{12}(d, n)N^{13}$ has been followed up to E_d = 20 MeV by observing the N^{13} activity induced in a stack of polyethylene foils (only the ground state is stable against proton emission). The cross-section falls appreciably less rapidly than would be expected for compound nucleus formation and also less rapidly than predicted by simple stripping theory. The cross-section at E_d = 8 MeV is 100 mb which is not so large relative to that for the mirror (d, p) reaction as is predicted by simple stripping theory. The reaction $C^{12}(d, t)C^{11}$ has been detected and its total cross-section measured from its threshold (E_d = 14.5 MeV) to E_d = 20 MeV where it is 10 mb. The magnitude of this cross-section indicates that this is a pickup reaction. A.

539.172.13

657. (d, n) REACTIONS IN O^{16} AND N^{14}. J.B.Marion, R.M.Brugger and T.W.Bonner.
Phys. Rev., Vol. 100, No. 1, 46-51 (Oct. 1, 1955).

The technique of observing neutron thresholds in (p, n) and (d, n) reactions has been applied to the reactions $O^{16}(d, n)F^{17}$ and $N^{14}(d, n)O^{15}$. A nuclear resonance absorption magnetometer, in conjunction with a 90° magnetic analyser, was used to accurately measure the bombarding energies. The $Li^7(p, n)Be^7$ threshold was used as the primary calibration. The energy of the first excited state of F^{17} was found to be 0.499 ± 0.003 MeV; excited states in O^{15} were found at 6.20 ± 0.03, 6.841 ± 0.009 and 6.909 ± 0.009 MeV. Ten broad resonances in the forward yield of neutrons from the reaction $O^{16}(d, n)F^{17}$ have been found in the range of bombarding energies from 1.8 to 4.3 MeV. The cross-section for the $N^{14}(d, n)O^{15}$ reaction increases with the deuteron energy in the range 1.1 to 4.5 MeV; a sharp rise in the cross-section begins at a bombarding energy of 2.1 MeV. The absolute cross-sections for the $O^{16}(d, n)F^{17}$ and $N^{14}(d, n)O^{15}$ reactions were measured. A.

539.172.13

658. (d, n) REACTIONS ON BORON AND CARBON. J.B.Marion, T.W.Bonner and C.F.Cook.
Phys. Rev., Vol. 100, No. 3, 847-51 (Nov. 1, 1955).

The counter ratio method has been used to investigate neutron thresholds in the (d, n) reactions on B^{10}, B^{11}, C^{12} and C^{13}. Thresholds were found corresponding to excited states in C^{11*} at 8.107, 8.430 and 8.660 MeV; in C^{12*} at 15.100MeV; in N^{13*} at 2.37 MeV; and in N^{14*} at 5.683 MeV. Resonances in the reaction $C^{12}(d, n)$ were found at 3.01 and 3.36 MeV and in the reaction $C^{13}(d, n)$ at 1.80, 2.45 and 3.46 MeV. The absolute cross-sections for the reactions $B^{10}(d, n)$, $B^{11}(d, n)$ and $C^{13}(d, n)$ were measured. A.

539.172.13

659. ANGULAR DISTRIBUTIONS OF PROTONS FROM $Be^9(He^3, p)B^{11}$. H.D.Holmgren, M.L.Bullock and W.E.Kunz.
Phys. Rev., Vol. 100, No. 1, 436 (Oct. 1, 1955).

A graph is given for the angular distributions of protons from the ground state and first excited state of Be^{11} from this reaction. Both proton groups show a marked asymmetry about 90°, indicating that the reactions do not proceed exclusively through the formation of a compound nucleus unless levels of opposite parity contribute. J.Hughes

539.172.3

660. (γ, α) PROCESSES IN HEAVY NUCLEI. P. Erdös, P. Jordan and P. Stoll.
Helv. phys. Acta, Vol. 28, No. 4, 322-3 (1955). In German.

A number of (γ, α) cross-sections have been determined. That for Cl has been measured at 31.5 MeV by exposing Kodak NT 1a emulsion containing AgCl instead of AgBr to the radiation from the 31.5 MeV betatron. Using the known value for Cl^{37}, that for Cl^{35} is 13 ± 3 MeV. mb. That for Ag^{109} has been obtained by irradiating 100 g of pure Ag and measuring the activity of a 41 ± 4 hr half-life attributed to Rh^{105}, the result being $\sigma(Ag^{109}(\gamma, \alpha)Rh^{105}) = 0.2 \pm 0.05$ MeV. mb. By irradiating pure antimony, and measuring the β-activity of the separated $In(OH)_3$ (which shows a half-life of 2hr) compared with that of an irradiated monitor foil of Cu^{66}, the cross-section for the $Sb^{121}(\gamma, \alpha)I^{117}$ reaction has been obtained as 0.4 ± 0.02 MeV. mb. D. J. Prowse

539.172.3

661. A SIMPLE THEORY OF THE $^7Li(\gamma, ^3H)^4He$ REACTION. W.Czyż.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 320-2 (Aug., 1955).

Results of cross-section and angular distribution calculations are presented, and compared with experimental data. The calculations assume a two-body (t-α) model of Li^7. J.J.Wilkins

539.172.3

662. PHOTOPROTON–PROTON COINCIDENCES FROM VARIOUS NUCLEI. R.M.Weinstein, A.Odian, P.C.Stein and A.Wattenberg.
Phys. Rev., Vol. 99, No. 5, 1621-2 (Sept. 1, 1955).

Photoproton–proton coincidences have been detected from Li and O targets irradiated with 340 MeV bremsstrahlung. The yield is about 1% of n-p coincidences (Abstr. 9608/1954), and may be accounted for by scattering of the neutrons of n-p pairs inside the target nuclei. J.J.Wilkins

539.172.3

663. PHOTONUCLEAR EFFECT. S.Rand.
Phys. Rev., Vol. 99, No. 5, 1620-1 (Sept. 1, 1955).

Total absorption cross-sections and mean absorption energies have been calculated, including a velocity-dependent term in the Hamiltonian (Abstr. 5889/1955). The results are consistent with experimental data. J.J.Wilkins

539.172.3

664. DEUTERON-MODEL CALCULATION OF THE HIGH-ENERGY NUCLEAR PHOTOEFFECT. K.G.Dedrick.
Phys. Rev., Vol. 100, No. 1, 58-66 (Oct. 1, 1955).

The high-energy nuclear photoeffect has been calculated according to the "deuteron model" of Levinger. In this model, the photoprocess occurs when a neutron and a proton which are scattering one another inside the nucleus absorb the energy of the incident photon and escape from the nuclear potential well into the laboratory. The nuclear photoeffect cross-section is then obtained by averaging the cross-section for the above process over all possible neutron-proton pairs in the nucleus, assuming a nucleon momentum distribution. The electric dipole and quadrupole interactions of the radiation field with the neutron and proton are included, and the magnetic terms are neglected. The averaging over all neutron-proton pairs is performed by means of a random flight formulation of the problem. The analytical work involved may conveniently be done using either a zero-temperature Fermi ground-state nucleon momentum distribution or a Gaussian distribution. Nu-

merical results for the energy and angle distributions of photoneutrons and photoprotons are presented in the case of the Gaussian distribution, for four photon energies between 50 and 125 MeV. A.

539.172.3

665. PHOTONUCLEAR YIELDS OF N^{17}. D.Reagan
Phys. Rev., Vol. 100, No. 1, 113-20 (Oct. 1, 1955).

Yields of N^{17} from several elements have been measured as functions of electron energy and converter thickness for bombardments from the Stanford linear electron accelerator. After correction for the electron-produced part of the yield, the $O^{18}(\gamma, p)$ and $F^{19}(\gamma, 2p)$ yields can be fitted (within statistics) to isochromats characteristic of 25 and 40 MeV photon energies, indicating integrated cross-sections of 0.067 and 0.0037 MeV.barn, respectively. The neon and sodium yields are similar, one to the other, in their energy dependence, and indicate a N^{17} photoproduction cross-section of the order of 3×10^{-30} cm^2 in the 100 MeV region, rising to the neighbourhood of 3×10^{-29} cm^2 at 200 MeV. The cross-sections estimated for N^{17} photoproduction in magnesium and aluminium rise from about 2×10^{-30} cm^2 in the 80 to 180 MeV region to around 3×10^{-29} cm^2 at 400 MeV. Estimating the N^{17} cross-section to be about 1% of the total photoabsorption cross-section leading to A = 17 isobar production at high energies gives order-of-magnitude agreement with photomeson cross-sections. This is consistent with the idea that direct photonuclear cross-sections are small at high energies, and that the large apparent photonuclear cross-section is due to indirect processes involving photomesons. A.

539.172.3

666. NUCLEAR SCATTERING OF LOW-ENERGY PHOTONS. J.L.Burkhardt.
Phys. Rev., Vol. 100, No. 1, 192-8 (Oct. 1, 1955).

The elastic photon scattering cross-sections at 90° for lead, indium, cadmium and copper have been measured between 0.5 and 3.0 MeV. Besides the expected Rayleigh scattering by bound electrons and Thomson scattering by the nucleus, a scattering component due to nuclear excitation is evident in the cross-sections. The mechanism of this scattering is discussed. A.

539.172.3

667. PHOTOEXCITATION OF THE ISOMERIC STATE OF INDIUM-115. J.L.Burkhardt, E.J.Winhold and T.H.Dupree.
Phys. Rev., Vol. 100, No. 1, 199-202 (Oct. 1, 1955).

The cross-section for photoexcitation of In^{115m} has been measured between 1 and 14 MeV. The cross-section is found to rise to a narrow peak at 8 MeV, 2 MeV wide, of maximum value 1.2 mb. This peak is interpreted as the result of competition from neutron emission by the excited nucleus. Clear evidence for sharp levels in the excitation cross-section is found below 2 MeV and the integral cross-sections for two levels are determined approximately. A.

539.172.4

668. ON THE EXISTENCE OF A DIFFERENCE IN THE RETENTIONS OF THE ISOMERIC NUCLEI OF Br^{80}_{35} AFTER NEUTRON CAPTURE. P.C.Capron and L.J.Gilly.
J. Chim. phys., Vol. 52, No. 6, 505-9 (June, 1955). In French.

Isopropyl bromide was exposed to thermal and fast neutrons from a 2.4 g Ra-Be source for either 20 min or 180 min. The induced radioactivity is due to the two isomeric Br^{80} nuclei, with a half-life of 4.4 hr and 18 min respectively (Abstr. 1679/1954). The isomeric transition transforms the 4.4 hr nucleus into the 18 min daughter nucleus. The isopropyl bromide was extracted with H_2O at different times after the exposure. The organic and the aqueous phases were counted in a liquid counter in order to find the difference in the retention of the two isomeric nuclei. Results obtained after 20 min exposure contradicted those obtained after 180 min exposure and did not allow any definite conclusions. The authors state that a purer isopropyl bromide, shorter exposure times and a stronger neutron source were required for the success of the experiment. M.Ebert

539.172.4

669. THE COMPLEX NUCLEAR POTENTIAL IN THE STUDY OF THE SCATTERING OF NEUTRONS. P.Meyer.
Cahiers de Phys., No. 59, 5-15 (July, 1955). In French.

Reviews the theory of the fine and coarse resonance structure in the neutron total cross-sections of nuclei between 0 and 3 MeV. J.M.Cassels

539.172.4

670. MEASUREMENT OF THE EFFECTIVE CAPTURE CROSS-SECTION OF U^{236} FOR A PILE SPECTRUM OF NEUTRONS. J.-M. Auclair, P. Hubert, R. Joly and G. Vendryès.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 392-3 (July 25, 1955). In French.

Absolute measurement of the beta-activity of the U^{237} formed in a pile by irradiation of U^{236} gave a value of 24 ± 7 barn for the capture cross-section. The reaction U^{238} (n, 2n) U^{237} was separately studied. J. M. Cassels

539.172.4

671. SIZE DISTRIBUTION OF NEUTRON WIDTHS.
D.J.Hughes and J.A.Harvey.
Phys. Rev., Vol. 99, No. 2, 1032-3 (Aug. 1, 1955).

Experimental slow neutron total cross-sections of heavy elements are surveyed to determine the size distribution of the reduced neutron widths of the resonance levels, and the result is compared with theoretical predictions. J.M.Cassels

539.172.4

672. NEUTRON-INDUCED REACTIONS IN FLUORINE.
J.B.Marion and R.M.Brugger.
Phys. Rev., Vol. 100, No. 1, 69-74 (Oct. 1, 1955).

By measuring the radioactivity produced when F^{19} is bombarded with monoenergetic neutrons, the excitation functions and absolute cross-sections have been obtained for the $F^{19}(n, \alpha)N^{16}$ and $F^{19}(n, p)O^{19}$ reactions from energies at which the respective activities were first observed to 8.0 MeV. The occurrence of the (n, α) reaction was first observed at a bombarding energy of 3.1 MeV; the (n, p) reaction was first observed at 4.7 MeV. Several resonances were found in the (n, α) excitation function, while the (n, p) excitation function showed a single maximum at 7.5 MeV. For neutron energies up to 8.0 MeV, the (n, α) reaction cross-section is larger than that for the (n, p) reaction by a factor of 2 or greater. A.

539.172.4

673. SLOW NEUTRON RESONANCES OF MANGANESE, BISMUTH AND SELENIUM. L.M.Bollinger, D.A.Dahlberg, R.R.Palmer and G.E.Thomas.
Phys. Rev., Vol. 100, No. 1, 126-34 (Oct. 1, 1955).

The apparatus associated with the Argonne fast neutron "chopper" and techniques that have been developed for its use in neutron transmission measurements are described. Of particular importance is the application of a boron-loaded liquid scintillation counter for the efficient detection of slow neutrons. The nature of the data that are obtained is illustrated by the results given for bismuth, selenium and manganese. Several techniques for finding neutron resonance parameters and their application to the above data are discussed. Resonance widths are found for the first two levels in bismuth. For the levels in selenium the measurements give only $\sigma_0\Gamma^2$. A complete set of parameters is obtained for the first three manganese resonances. The abnormally large ratio of neutron width to level spacing for manganese produces an unusual shape for the cross-section curve in the neighbourhood of the second resonance which is interpreted as being caused by interference between the second and third resonances. For this interpreta-

tion results obtained are: J = 2 for E_o = 337 eV, J = 3 for E_o = 1080 eV and J = 3 for 2360 eV. A.

539.172.4

674. NONELASTIC SCATTERING CROSS SECTIONS FOR FAST NEUTRONS. H.L.Taylor, O.Lönsjö and T.W.Bonner.
Phys. Rev., Vol. 100, No. 1, 174-80 (Oct. 1, 1955).

Measurements have been made of the nonelastic cross-sections of neutrons in Be, C, Al, Ti, Cr, Fe, Ni, Cu, Ag, Sn, Pb and Bi. The cross-sections include all processes except elastic scattering. The experiments have been carried out with monoenergetic neutrons of 3.5, 4.7, 7.1, 12.7 and 14.1 MeV. The neutrons were produced with a Van de Graaff accelerator using the nuclear reactions: $T^3(p, n)He^3$, $D(d, n)He^3$ and $T^3(d, n)He^4$. Cross-sections were determined from transmissions through spherical shells which were 3.8 cm in radius and 2 cm thick. A new type of neutron detector which gives energy information about neutrons and is insensitive to gamma-radiation was placed at the centre of the spherical shell and was used as a biased detector of neutrons. The results of these experiments show that the nonelastic neutron cross-section for 12.7 and 14.1 MeV neutrons is nearly geometrical and is closely approximated by $\sigma = \pi(R + \lambda)^2$, where $R = 1.4 \times 10^{-13} A^{1/3}$ The nonelastic cross-sections are roughly constant in the energy range 5 to 14 MeV; below about 5 MeV the cross-sections begin to decrease. The elastic cross-sections can be obtained by subtracting the nonelastic cross-sections from the total cross-sections. The variations with energy of the nonelastic and elastic cross-sections are quite different. Data with 12.7 MeV neutrons and low counter bias, give the relative number of gamma-rays given off per inelastic collision of these neutrons. The number of gamma-rays decreases rapidly with increasing atomic number and there are less than 5% as many gamma-rays from Bi as from Al, Ti, Cr and Fe. A.

539.172.4

675. LOW ENERGY NEUTRON CROSS SECTION OF MANGANESE. R.Krotkov.
Canad. J. Phys., Vol. 33, No. 11, 622-34 (Nov., 1955).

The total neutron cross-section of Mn^{55} has three (predominantly scattering) resonances in the energy range 300-2500 eV. In the present paper these resonances are examined in detail from the point of view of the R matrix formalism. It is found that quite good (but not perfect) agreement with the experimental cross-section curve is obtained by assigning (in order of increasing resonance energy(spins (2, 3, 3) and neutron widths (23, 11, 395 eV) to the resonances. The addition of a constant increment $\triangle R_{11} = 0.16 \times 10^{-12}$ cm (representing the contribution of distant, positive energy, J = 3 resonances to the R matrix element for s-neutron scattering) improves agreement with experiment on the high-energy side of the highest energy resonance. The (n, γ) cross-section at 0.025 eV is fitted well by a constant radiation width of 0.5 eV. However, with no set of parameters was it possible to fit both the experimental total cross-section curve, and the observed coherent scattering cross-section at 0 eV, although the sign of the latter was accounted for correctly. The discrepancy is 2.0 barn (calculated) compared to 1.7 barn (observed). A.

539.172.4

676. THEORY OF NEUTRON REACTIONS WITH NUCLEI AT LOW ENERGY. K.A.Brueckner, R.J.Eden and N.C.Francis.
Phys. Rev., Vol. 100, No. 3, 891-900 (Nov.1, 1955).

A theory of the interaction of low-energy neutrons with nuclei has been developed using methods previously applied to the study of the nuclear ground state. It is shown that an average potential is predicted by the theory which very closely resembles that used by Feshbach, Porter, and Weisskopf in their studies of the neutron cross-sections. The calculated parameters for scattering at a few MeV are a real depth of 41 MeV and an imaginary part somewhat less than 1 MeV. The theory also predicts the appearance of characteristic narrow compound-state resonances in the cross-section; these are the result of sharp fluctuations in the real and imaginary part of the equivalent potential acting on a neutron which are the result of appreciable coupling between the single-particle and compound-nucleus states. An estimate of the level width is given for a simple class of compound-state levels and is of the order of typical widths observed experimentally. A comparison of these results is made with a theory of Wigner, Lane, and Thomas; the principal difference is in the much smaller imaginary part of the potential determined by this theory. A.

539.172.4 : 539.172.13

677. COLLISION MATRIX FOR (n, d) AND (p, d) REACTIONS. R.G.Thomas.
Phys. Rev., Vol. 100, No. 1, 25-32 (Oct. 1, 1955).

The contributions to (n, d), (p, d) reactions and their inverses from the pickup and stripping mechanisms are considered as corrections to the compound-nucleus or R-matrix theory of nuclear reactions. In an (n, d) reaction, for example, the R-matrix theory neglects the interaction of the incident neutron with the target-nucleus proton "tails" which extend beyond the nuclear radius. The pickup correction to the collision-matrix component, or reaction amplitude, appears as the matrix element of the neglected interaction involving an exact wave-function and the approximate wave-function of the compound-nucleus system not having the interaction; a distorted-wave Born approximation is used in which the former exact wave-function is replaced by one of the latter type with the appropriate radiation condition. An explicit expression is given for the collision-matrix component which, together with the compound-nucleus contribution, can be substituted directly into the formulae of Blatt and Biedenharn for total reaction cross-sections and angular distributions. In general, the angular distributions contain interference terms in addition to the straight pickup and compound-nucleus contributions. If the distorted neutron and deuteron spherical partial waves are assumed to depend only on the angular momenta, and not explicitly on the total spin and the channel spins, the formula of Tobocman is obtained for the pickup contribution, while Butler's formula is obtained if plane waves are used instead of distorted waves. There are discussions of the various approximations, the exchange terms, and the question of the nuclear radius. A.

539.172.4

678. NEUTRON-INDUCED FISSION CROSS SECTIONS OF U^{234} AND U^{236}. R.W.Lamphere and R.E.Greene.
Phys. Rev., Vol. 100, No. 3, 763-70 (Nov. 1, 1955).

The fission cross-sections of the uranium isotopes, 234 and 236, have been measured from their thresholds to 4.0 MeV neutron energy by use of neutrons from the $T(p, n)He^3$ reaction. Neutron energy spread varied from 60 to 100 keV for most points. U^{234} has a threshold at about 300 keV, rises to 1.24 barns at 850 keV, dips to 1.08 barns at 1.06 MeV, rises to 1.47 barns at 1.9 MeV, dips to 1.40 barns at 2.4 MeV, and then rises to 1.55 barns at 4.0 MeV. Variations in between these points appear smooth with the energy spread present in the neutron beam. Similarly, U^{236} has a threshold at about 670 keV, rises to 0.36 barn at 970 keV and remains nearly constant to 1.04 MeV when it again rises, reaching 0.75 barn at 1.4 MeV, falling to 0.66 barn at 1.56 MeV, rising to 0.89 barn at 2.5 MeV, falling to 0.87 barn at 2.7 MeV, and then rising to 0.99 barn at 4.0 MeV. The thresholds referred to are the energies at which the cross-sections are only about 1% of their values on the relatively flat portion of the curve between 2 and 3 MeV. Results are believed to be accurate to 6.0%. A.

539.172.4

679. THE FISSION YIELDS OF THE CESIUM ISOTOPES FORMED IN THE THERMAL NEUTRON FISSION OF U^{235} AND THE NEUTRON ABSORPTION CROSS SECTION OF Xe^{135}. J.A.Petruska, E.A.Melaika and R.H.Tomlinson.
Canad. J. Phys., Vol. 33, No. 11, 640-9 (Nov., 1955).

The absolute fission yields of the caesium isotopes occurr-

ing in the thermal neutron fission of U^{235} have been determined with a mass spectrometer using isotope dilution techniques. Values of 6.59%, 6.41% and 6.15% have been obtained for the yields of Cs^{133}, Cs^{135} and Cs^{137} respectively. The neutron absorption cross-section of Xe^{135} has also been measured to be 866 times greater than that of B^{10} for a Maxwellian distribution of neutron velocities corresponding to a neutron temperature of 57° C. This ratio gives a thermal neutron absorption cross-section of 3.47 x 10^6 barn for Xe^{135} assuming it is a 1/v detector. A.

539.172.4

680. THE ABSOLUTE FISSION YIELDS OF TWENTY-EIGHT MASS CHAINS IN THE THERMAL NEUTRON FISSION OF U^{235}. J.A.Petruska, E.G.Thode and R.H.Tomlinson.
Canad. J. Phys., Vol. 33, No. 11, 693-706 (Nov., 1955).

Twenty-eight absolute fission yields totalling 78% of the heavy and 16% of the light fragments have been determined using the mass spectrometer and isotope dilution techniques. The precision of the values obtained in most cases better than 2% and the absolute accuracy is estimated to be about 3%. Fine structure in the mass—yield curve is discussed in terms of structural preference and various chain branching mechanisms. A.

539.172.4 : 539.185.7

681. INTERNATIONAL VALUES OF THE EFFECTIVE CROSS-SECTIONS OF FISSILE NUCLIDES FOR THERMAL NEUTRONS.
Science, Vol. 122, 409 (Sept. 2, 1955); C.R. Acad. Sci. (Paris), Vol. 241, No. 10, 669 (Sept. 5, 1955). In French; Nature (London), Vol. 176, 619 (Oct. 1, 1955).

Published values of the cross-sections for absorption and fission of U^{233}, U^{235} and Pu^{239} show some discrepancies. At the Geneva conference on the Peaceful Uses of Atomic Energy, it was decided to prepare a set of "world average" values for these cross-sections, which are given below (in barns) for thermal neutrons (2200 m/s):

	Absorption	Fission
Uranium - 233	593 ± 8	524 ± 8
Uranium - 235	698 ± 10	590 ± 15
Plutonium - 239	1032 ± 15	729 ± 15

The quoted errors are based on the spread in reported results.

539.172.4

682. TURBINE CONTAMINATION CAUSES ONLY SMALL PROBLEM WITH BOILING-WATER REACTORS. S.Untermyer.
Nucleonics, Vol. 13, No. 8, 52, 54, 55, 58, 60 (Aug., 1955).

Activities deposited in the turbine by the steam from a direct boiling-water reactor, are calculated. The water is assumed to be continuously purified and the activities arise from corrosion products and an assumed fission-product release resulting from fuel element failures. It is shown that the levels of activity in the turbine, one day after shut-down following prolonged operation, should be sufficiently low to allow direct maintenance. L.R.Shepherd

539.172.4 : 621.039 : 621-5

683. EQUILIBRIUM AND CONTROL OF ARTIFICIAL AND TEMPERATURE STABILIZATION OF POWER (NUCLEAR) REACTORS. J.Grabscheid.
Elektrotech. u. Maschinenbau (EuM), Vol. 72, No. 15-16, 384-99 (Aug. 1, 1955). In German.

A thermal nuclear reactor has a negative temperature coefficient, i.e. the power decreases with increasing temperature, and to produce constant power this effect is assisted by the automatic manipulation of control rods. An outline of the control system for a complete unit, including steam boiler and turbine, is given and the behaviour investigated mathematically. E.O.Taylor (R)

539.174

684. COULOMB EXCITATION OF RARE-EARTH NUCLEI WITH ALPHA PARTICLES. N.P.Heydenburg and G.M.Temmer.
Phys. Rev., Vol. 100, No. 1, 150-66 (Oct. 1, 1955).

Using a doubly-charged He beam at 6 MeV most low-lying (rotational) states have been excited in the nuclei between Z = 60 and Z = 73. Assignments were made with isotopically enriched targets where available. On the whole the predictions of the "strong coupling" approximation of the unified model are strikingly borne out by these observations. All 2^+ first-excited states of even-even nuclei lying below about 600 keV were observed, some of which were previously unknown. Two excited states were found in most odd-A nuclei as revealed by direct and/or cascade radiation to the ground state as well as coincidence measurements. The positions of the first two rotational levels agree with the simple interval rule in all established cases within the experimental accuracy. The majority of these states are not found in beta-ray spectroscopy. The reduced electric-quadrupole transition probabilities for all these transitions were measured and found to be some 50 to 100 times greater than those expected for an independent particle. Good agreement was found with some values of these quantities available from direct lifetime observations, giving confidence in the correctness of both the theoretical expression for the total excitation cross-section, and the experimental approach for its determination. A systematic decrease in these transition probabilities is evident in even-even nuclei upon approaching the closed-neutron shell at N = 82; a corresponding increase in the energy of the 2^+ levels reflects the common origin of both phenomena, namely the decrease of the intrinsic deformation of the nuclei. However, the absolute magnitude derived for this deformation depends upon which manifestation is used. Some evidence for a difference in splitting constants $\hbar^2/2\mathcal{I}$ between even-even, even-odd, and odd-even nuclei is found. Within the rather large uncertainties the transition probabilities do not seem to show a corresponding variation. A.

539.174

685. EFFECTS OF FINITE AMPLITUDE IN COULOMB EXCITATION. G.Breit and J.P.Lazarus.
Phys. Rev., Vol. 100, No. 3, 942-3 (Nov. 1, 1955).

Corrections to the usual theory, which takes into account only first-order effects of the field of the incident particle, can be quite appreciable. G.E.Brown

ATOM AND MOLECULE BEAMS.

MESONS. NEUTRONS 539. 18

539.18

686. FURTHER EVIDENCE FOR THE EXISTENCE OF A HEAVY K-MESON OR HEAVY HYPERON. W.F.Fry, J.Schneps and M.S.Swami.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 346-7 (Aug., 1955).

An event has been found which seems to require the existence of a heavy K-meson or hyperon. This heavy particle is emitted from a 17 + 3n star and after 44 μ when apparently at rest it ejects a K-meson of 42 MeV. The K-meson mass is determined as 1005 ± 200 m_e by constant-sagitta scattering measurements and 1024 ± 150 m_e by grain-density v. range. No decay particle has been observed so the K-meson is assumed to be negative. The interpretation suggested is that the K-meson is produced by the absorption of a "heavy" K-meson or hyperon. The mass, if a heavy K-meson, must be greater than 1051 m_e, although if momentum is to be balanced, it would have to appreciably exceed this; if a hyperon, it must be greater than 2887 m_e. D.J.Prowse

539.18

687. A CLOUD CHAMBER OBSERVATION OF A SINGLY CHARGED UNSTABLE FRAGMENT. G.Alexander, J.P.Astbury, C.Ballario, R.Bizzarri, B.Brunelli, A.De Marco, A.Michelini, G.C.Moneti, E.Zavattini and A.Zichichi.
Nuovo Cimento (Series 10), Vol. 2, No. 2, 365-9 (Aug., 1955).

An event has been observed in a cloud-chamber photograph which can be interpreted as the decay in flight of an unstable hydrogen isotope with the emission of a Λ^0 particle.
A.J.Egginton

539.18

688. CLOUD-CHAMBER OBSERVATIONS ON CHARGED V PARTICLES. W.H.Arnold, J.Ballam and G.T.Reynolds.
Phys. Rev., Vol. 100, No. 1, 295-302 (Oct. 1, 1955).

In an experiment utilizing the double cloud-chamber technique at an altitude of 10 600 ft, 46 charged V particles have been observed. Where possible these have been classified according to the value, p*, of the momentum of the charged decay particle in the rest system of the primary particle. On this basis decaying particles have been classed as: 1. Consistent with two-body decay of known heavy mesons and not consistent with known hyperons. 2. Consistent with two-body decay of heavy measons but also consistent with two-body decay of hyperons. 3. Not consistent with two-body decay of heavy mesons. In the first group it is generally not possible to distinguish between the possibilities $\theta \rightarrow \pi + \pi^0$, on the one hand and $K_{\mu 2} \rightarrow \mu + \nu$ on the other. However, several cases suggest strongly the θ particle and yield an average mass $953 \pm 18\ m_e$. Several other special decay events are reported. After classification by p*, lifetime measurements are made on groups consistent with two-body heavy meson decay. The nine positive events in this class give a lifetime $3.7 \times 10^{-10} < \tau < 8.5 \times 10^{-10}$ sec with 50% confidence limits, and 7% probability that $\tau > 5 \times 10^{-9}$ sec. The six negative events in this class give a lifetime $3.0 \times 10^{-10} < \tau < 8.0 \times 10^{-10}$ sec with 50% confidence limits and 11% probability that $\tau > 5 \times 10^{-9}$ sec. Effects of possible biases are discussed and it is concluded that these lifetimes characterize the charged θ-meson. No unambiguous examples of the $K_{\mu 3}$ or Ke_3 heavy mesons were observed.
A.

539.18

689. ON THE IDENTIFICATION OF CHARGED HYPERONS AND THE ESTABLISHMENT OF THEIR DECAY SCHEMES IN NUCLEAR EMULSIONS. A.Bonetti.
Nuovo Cimento Suppl. (Ser. 10), Vol. 2, No. 1, 231-8 (1955).

Mass measurements on primary particles, though establishing the existence of particles of mass definitely different from those of the other unstable particles observed up to now in nuclear emulsions, do not give a precise value for the mass nor the possible fine structure of the mass distribution. It is suggested that more accurate information is obtained from the analysis of the decay of these particles. Thus, the particles of hyperprotonic mass observed in nuclear emulsions have been collected in four groups according to their decay schemes. Mass values suggested are 2327 and 2580 m_e, apart from a hypothetical 2181.
E.W.Kellermann

539.18

690. AN ANALYSIS OF A Λ^0-PARTICLE (DECAY) IN FLIGHT RECORDED IN NUCLEAR EMULSION. P. Ciok and A. Stegner.
Acta phys. Polon., Vol. 14, No. 1-2, 153-5 (1955).

A Λ^0-particle decay is analysed to obtain an accurate Q-value. The π^--meson was stopped and its energy therefore known. The momentum of the proton was determined from an analysis of two elastic p–p collisions. The final result is 35.2 ± 1.2 MeV.
D. J. Prowse

539.18

691. THE LIFETIME OF THE τ-MESON. W.Alvarez and S.Goldhaber.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 344-5 (Aug., 1955).

From an analysis of the results obtained by various groups at Berkeley on K-mesons using two experimental exposure arrangements, (re-entrant-well exposures with no magnetic resolution, 90° to the target at a distance of $11\frac{1}{2}$ in. and exposures with magnetic resolution, 106 in. from the target) the lifetime of the τ-meson has been determined. The well exposures yielded a total of 10 τ-mesons. All groups tabulated the number of K_L-mesons and τ-mesons stopping at a range corresponding to a momentum of about 350 ± 15 MeV/c and the number of π-mesons stopping at the same range. The number of 350 MeV/c protons and the number of π-mesons that stop at a range corresponding to 350 MeV/c K-mesons have also been counted in exposures carried out in a well with a 0.1 in. aluminium window. In the magnetically resolved experiments, the K_L and τ-mesons were counted relative to the number of protons of 350 MeV/c. These exposures yielded 60 τ-mesons. Hence the ratio of the number of τ-mesons to protons of 350 MeV/c was known at two distances. This ratio gives a mean life for the τ-meson of $1.0 + 0.07 - 0.03 \times 10^{-8}$ sec.
D.J.Prowse

539.18

692. BREMSSTRAHLUNG ACCOMPANYING COLLISIONS OF π-MESONS WITH NUCLEONS. V.G.Solov'ev.
Zh. éksper. teor. Fiz., Vol. 29, No. 2(8) 242-5 (1955). In Russian.

The cross-section is calculated by third-order perturbation theory employing pseudoscalar mesons with pseudoscalar and with pseudovector coupling. The nucleons are considered as non-relativistic. Angular distributions are given for limiting cases.
G.E.Brown

539.18

693. RANGE–ENERGY RELATION AND MASSES OF THE NEW PARTICLES. D.O.Caldwell.
Phys. Rev., Vol. 100, No. 1, 291-4 (Oct. 1, 1955).

The accuracy to which the masses of most of the new unstable particles can be determined is now limited principally by the uncertainty in the range–energy relations at large velocities. The extent of this uncertainty is indicated, and the available data are re-examined to try to find the best relations to use. In particular, shell corrections are applied to the Sachs–Richardson data, and the mean excitation potentials for nine elements are determined. The evidence for Al, Cu and emulsion indicates that the mean excitation potentials are not velocity dependent, and that they may be considerably larger than the values commonly used.
A.

539.18

694. PHASE SHIFT ANALYSIS FOR NEGATIVE PION–PROTON SCATTERING AT 187 MeV. E.Clementel, G.Poiani and C.Villi.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 352-5 (Aug., 1955).

An analysis using the analytical method proposed by the authors (Abstr. 9962/1955).
P.T.Matthews

539.18

695. SCATTERING OF PIONS BY HYDROGEN AT 165 MeV. H.L.Anderson and M.Glicksman.
Phys. Rev., Vol. 100, No. 1, 268-78 (Oct. 1, 1955).

Measurements of the elastic scattering of both positive and negative pions, and of the charge exchange scattering of negative pions were carried out at each of five angles, at 165 MeV using a liquid hydrogen target. In addition, the total cross-sections for positive and negative pions were measured by the transmission method. Integration of the differential measurements gave total cross-sections of 199 ± 11 mb for the positive, and 69.8 ± 3.8 mb for the negative pions. The corresponding cross-sections obtained by transmission were 188.2 ± 5.4 mb and 67.5 ± 1.5 mb, respectively. A least-squares analysis was carried out on the seventeen data to

determine the most probable values of the phase-shifts, limiting the analysis to s and p waves. Seven solutions were found, three being of the Fermi type, the others of the Yang type. The Fermi type solutions gave α_{33} near 63^0, α_3 near -20^0, with the other phase-shifts small. A.

539.18

696. SCATTERING OF POSITIVE PIONS BY HYDROGEN AT 189 MeV. H.L.Anderson, W.C.Davidon, M.Glicksman and U.E.Kruse.
Phys. Rev., Vol. 100, No. 1, 279-87 (Oct. 1, 1955).

The differential and total cross-section of pions on hydrogen has been measured for 189 MeV positive pions. Liquid hydrogen was used as the scatterer; the incident and scattered pions were detected with scintillation counters. The angular distribution was fitted by: $\sigma = (7.24 \pm 0.76) + (3.1 \pm 1.3) \cos\chi + (25.6 \pm 2.6) \cos^2\chi$ millibarns per sterad. The total cross-section measured by transmission was 194.1 ± 5.2 millibarns. A phase-shift analysis was made using these results in conjunction with data obtained previously on the scattering of negative pions. The analysis was restricted to S and P waves and assumed conservation of isotopic spin. Four solutions were obtained. The one which is consistent with the requirements of causality and which corresponds to the preferred solution of de Hoffmann et al. is $\alpha_1 = -2.8^0 \pm 4.5^0$, $\alpha_3 = -11.3^0 \pm 3.2^0$, $\alpha_{11} = -2.6^0 \pm 7.5^0$, $\alpha_{13} = -2.1^0 \pm 3.8^0$, $\alpha_{31} = -11.6^0 \pm 5.1^0$, $\alpha_{33} = 98.8^0 \pm 3.6^0$. A.

539.18

697. ENERGY DEPENDENCE OF THE PHASE SHIFTS IN PION–PROTON SCATTERING. J.Orear.
Phys. Rev., Vol. 100, No. 1, 288-91 (Oct. 1, 1955).

It is shown that all pion–proton scattering data up to 300 MeV can be fit within limits of experimental error by using the s-waves linearly extrapolated from the low-energy slopes of $\alpha_1 = 0.16\eta$ and $\alpha_3 = -0.11\eta$. All other phase-shifts are assumed zero except $_{33}$ which is given the energy dependence proposed by Chew and Low, $\eta^3/\omega^* \cot\alpha_{33} = 8.05 - 3.8\omega^*$. The two constants in the α_{33} energy dependence fit the initial slope of $\alpha_{33} = 0.235\eta^3$ as determined from low-energy experiments and make α_{33} go through 90^0 at 192 MeV. According to the cutoff theory this determines a $k_{max} \simeq 6\mu c/\hbar$, corresponding to a pion–nucleon interaction of much shorter range than $\hbar/\mu c$. A theoretical implication of the fit proposed here is that also the s-wave interaction range is less than $\hbar/\mu c$. A.

539.18

698. CAUSALITY IN THE PION-PROTON SCATTERING. H.L.Anderson, W.C.Davidon and U.E.Kruse.
Phys. Rev., Vol. 100, No. 1, 339-43 (Oct., 1, 1955).

Dispersion relations applicable to particles with mass and charge have been used for analysing pion-proton scattering data. In these relations, experimental values of the total cross-sections for π^+ and π^- from 0 to 1.9 BeV were used to calculate the real part of the forward scattering amplitudes, and th these were compared with the results of phase-shift analyses. With suitable choice of the pion-nucleon coupling constant, good agreement can be obtained for the phase-shift solutions with a resonant behaviour for α_{33}. A.

539.18

699. SCATTERING OF MESONS BY A FIXED SCATTERER. F.J.Dyson.
Phys. Rev., Vol. 100, No. 1, 344-8 (Oct. 1, 1955).

The meson–nucleon scattering equations of Chew and Low are generalized to the case of mesons and scatterers having arbitrary angular momenta. In consequence, the algebraic structure of the equations is made clearer. Two coupling schemes for the angular momenta are studied, the J-scheme in which momenta of meson and scatterer in the initial state are coupled, and the N-scheme in which the meson momenta in initial and final states are coupled. The condition of unitarity of the S-matrix is simple only in the J-scheme, the condition of causality is simple only in the N-scheme. The interlock between the two schemes gives rise to the peculiar linking of different J-values in the Chew–Low equations. The linkage coefficients are shown to be ordinary Racah coefficients. A.

539.18

700. NUCLEAR CAPTURE OF A NEGATIVE HEAVY MESON. E.A.Zamchalova, V.I.Karpova and M.I.Tret'yakova.
Zh. éksper. teor. Fiz., Vol. 29, No. 2(8) 245 (1955). In Russian.

This event is identified in photographic plates; a photograph of it is included. G.E.Brown

539.18

701. ON THE PROCESSES OF PRODUCTION OF HEAVY MESONS AND V_1^0-PARTICLES. B.M.Pontekorvo(Pontecorvo).
Zh. éksper. teor. Fiz., Vol. 29, No. 2 (8) 140-6 (1955). In Russian.

Processes are considered phenomenologically, with particular attention to the large probability of production, but long lifetime, of the τ- and V-particles, from which it is concluded that they may be produced in pairs by some mechanism. The system N + V, coupled by τ-mesons, may be quasi-static. G.E.Brown

539.18

702. ON THE ROLE OF ISOBARIC STATES OF NUCLEONS IN THE PRODUCTION OF MESONS. A.I.Nikishov.
Zh. éksper. teor. Fiz., Vol. 29, No. 2(8) 246 (1955). In Russian.

Calculations on the production of charged mesons in the reaction $Be^9 + p$ at energies 1–3 BeV give results in good agreement with experiment; a statistical model is employed in which direct production, and production via isobaric states, are considered. G.E.Brown

539.18

703. DOUBLE PION PRODUCTION IN NUCLEON–NUCLEON COLLISIONS. SELECTION RULES FOR PRODUCTION NEAR THRESHOLD. R.Gatto.
Nuovo Cimento (Ser. 10), Vol. 2, No. 2, 348-51 (Aug., 1955).

Selection rules based on S-waves for the relative motion of the nucleons, and S- or P-waves for the relative motion of the pions with respect to each other, and with respect to the nucleons. P.T.Matthews

539.18

704. PION PRODUCTION IN PROTON-PROTON COLLISION. D.B.Lichtenberg.
Phys. Rev., Vol. 100, No. 2, 303-6 (Oct. 1, 1955).

The cut-off form of the Yukawa theory is applied to the reaction $p + p \rightarrow \pi^+ + d$. Using the Low–Wick formulation of of field theory, an expression is obtained for the approximate matrix element in terms of the wave-functions of a physical deuteron and diproton. Approximations are made for these wave-functions and the matrix element is evaluated. The resulting cross-section agrees semiquantitatively with that part of the observed cross-section due to pions emitted in a p-state. A.

539.18

705. ELECTRONIC DETECTION OF HEAVY MESONS. K.W.Robinson.
Phys. Rev., Vol. 99, No. 5, 1606-7 (Sept. 1, 1955).

An arrangement of scintillation and Cherenkov counters was used to detect decays of heavy mesons with a time resolution of approximately one millimicrosecond. A.J.Egginton

539.185

706. SPATIAL DISTRIBUTION OF THERMAL NEUTRONS FROM A POLONIUM–BERYLLIUM SOURCE IN WATER–ZIRCONIUM MIXTURES. W. Baer.

J. appl. Phys., Vol. 26, No. 10, 1235-8 (Oct., 1955).

The spatial distribution of neutrons emitted by a Po–Be source and moderated by water–zirconium mixtures has been measured for four water–zirconium volume ratios. From these data, migration areas of source neutrons to energies below the cadmium cutoff have been determined with an uncertainty of ± 2%. The experimental values of the migration area M^2 are:

Zr/H_2O Ratio	$M^2(cm^2)$
0.00	69.6
0.25	81.3
0.50	89.7
1.00	112.8

539.185

707. ANGULAR DISTRIBUTION OF n–p SCATTERING AT 17.9 MeV. A.Galonsky and J.P.Judish.
Phys. Rev., Vol. 100, No. 1, 121-4 (Oct. 1, 1955).

The angular distribution of protons bombarded by 17.9 ± 0.1 MeV neutrons was measured at 11 angles from 2.5° to 50° in the laboratory system. At each angle the energy spectrum of protons producing a coincidence of pulses in two proportional counters and a NaI(Tl) crystal was measured in the NaI crystal. Each spectrum has a peak less than 25% wide at half-maximum and a small low-energy tail caused by Coulomb scattering of the protons in the detector. The error in each yield was between 2 and 3% for angles from 2.5° to 45° and 8% at 50°. A least square fit to the data gives 1.08 ± 0.03 for the ratio of the n–p scattering cross-sections at neutron angles 180° and 90° cm. A.

539.185

708. INELASTIC SCATTERING OF NEUTRONS FROM IRON BY TIME-OF-FLIGHT. L.Cranberg and J.S.Levin.
Phys. Rev., Vol. 100, No. 1, 434-5 (Oct. 1, 1955).

The energy spectrum of the scattered neutrons was measured by combining the time of flight and pulsed beam techniques. Typical spectra for the scattering of 2.45 MeV neutrons from iron and polyethylene are given. J.Hughes

539.185

709. POLARIZATION OF 350-MeV NEUTRONS ELASTICALLY SCATTERED FROM NUCLEI. R.T.Siegel.
Phys. Rev., Vol. 100, No. 1, 437-8 (Oct. 1, 1955).

A neutron beam, with polarization 0.16, was elastically scattered from targets of C, Al, Cu and Pb and the asymmetry was measured as a function of scattering angle with respect to the incident beam direction. The magnitudes of the neutron polarization produced by elastic scattering from light elements deduced from this asymmetry agree with those obtained for protons. J.Hughes

539.185 : 539.172.13

710. $V^{51}(p,n)Cr^{51}$ REACTION AS A 5- TO 120-keV NEUTRON SOURCE. J.H.Gibbons, R.L.Macklin and H.W.Schmitt.
Phys. Rev., Vol. 100, No. 1, 167-8 (Oct. 1, 1955).

This reaction provides a usable source of monoenergetic neutrons from 5 to 120 keV. The yield indicates resonances in Cr^{52} with an average spacing of less than 2 keV in this energy range. A preliminary measurement was made of the angular distribution of eleven of the more prominent peaks. A.

539.185 . 548.7

711. THE INELASTIC SCATTERING OF NEUTRONS BY A SINGLE CRYSTAL. A.Herpin and B.Jacrot.
J. Phys. Radium, Vol. 16, No. 7, 35 S - 39 S (July, 1955). In French.

Describes a method for the study of inelastic scattering in which the incident neutrons are roughly monochromatized by a crystal filter and a time-of-flight spectrometer is employed. The energy distribution in the scattered beam can be measured in different directions and related to energy exchanges, involving one or more phonons, between the neutrons and the crystal. J.Thewlis

539.185.08

712. NEUTRON SPECTROMETER USING CRYSTAL DIFFRACTION. J.M.Auclair, P.Hubert and G.Vendryès.
J. Phys. Radium, Vol. 16, No. 7, 50 S - 52 S (July, 1955). In French.

Describes a crystal spectrometer for use with a beam of collimated neutrons emerging from the reflector of the Saclay reactor. The main crystals used so far have been LiF, NaCl and Be, with either a BF_3 proportional counter or a fission chamber as detector. The apparatus has been used for measurements of variations in the fission cross-sections of U^{235}, Pu^{239} and U^{233}. The results agree with those obtained by a time-of-flight method. J.Thewlis

539.185.08

713. THIN SCINTILLATORS OF ZnS IN FUSED B_2O_3 FOR THERMAL NEUTRON DETECTION. S.B.Gunst, J.C.Connor and R.T.Bayard.
Rev. sci. Instrum., Vol. 26, No. 9, 894-5 (Sept., 1955).

Preparation and performance characteristics are discussed briefly. J.J.Wilkins

539.185.08

714. POTASSIUM IODIDE FAST NEUTRON DETECTOR. B.Brown.
Rev. sci. Instrum., Vol. 26, No. 10, 970-1 (Oct., 1955).

A fast neutron detector has been developed consisting of powdered thallium-activated potassium iodide dispersed in polystyrene. Recoil protons from the polystyrene are detected by potassium iodide. The detection efficiency of the potassium iodide detector for radium-beryllium neutrons is comparable to that of zinc sulphide dispersed in polystyrene. Potassium iodide has a longer decay time than zinc sulphide, permitting "phoswich" coincidence arrangements. The energy response of the potassium iodide detector is closer to the energy response of a thick hydrogenous radiator than that of a zinc sulphide detector. A.

STRUCTURE OF SOLIDS 539.2

539.217

715. DIFFUSION OF SILVER IN SILVER-ZINC AND SILVER-CADMIUM ALLOYS. T.Hirone, M.Kimura, T.Kitagaki, N.Kunitomi and Y.Sugita.
J. Phys. Soc. Japan, Vol. 10, No. 11, 967-70 (Nov., 1955).

Diffusivity of Ag^{110} in AgZn and AgCd alloys containing about 30% Zn or Cd was measured by means of surface counting. The results show that the silver atoms diffuse most rapidly in the lattice of AgZn and that the diffusivity of silver in AgCd is still higher than in silver itself. These facts are interpreted by considering that the cohesive energy of the metallic lattice is affected by the addition of the impurity atoms, not only because of the screening effect of the valence electrons but also because of the change of the repulsive interaction of closed shells. A.

539.217 : 539.16.08

716. A DIFFUSION METHOD OF DETERMINING THE THERMODYNAMIC CHARACTERISTICS OF SOLID SOLUTIONS. A.A.Zhukovitskiĭ, S.N.Kryukov, M.E.Yanitskaya and A.G.Golitsyn.
Dokl. Akad. Nauk SSSR, Vol. 102, No. 1, 121-4 (1955). In Russian.

The use of radioactive isotopes to measure thermodynamic characteristics is discussed. Methods based on measurement of the vapour pressure are shown to be laborious, and a new diffusion method of obtaining these characteristics is described. This consists in measuring the time variation of the radioactivity on a receiver due to the diffusion thither of a radioactive component of a solid solution. The equipment

is described, and the method of calculation is given. The results for pure silver and an equiatomic alloy of silver and gold are illustrated by graphs and a table, and are shown to be in good agreement with values previously given in the literature. J.B.Sykes

539.217 : 666 : 533.5

DIFFUSION OF GASES IN GLASS DURING OUTGASSING. See Abstr. 127.

539.219 : 537.311.33

717. A MATHEMATICAL ANALYSIS OF SOLUTE REDISTRIBUTION DURING SOLIDIFICATION. V.G.Smith, W.A.Tiller and J.W.Rutter.
Canad. J. Phys., Vol. 33, No. 12, 723-45 (Dec., 1955).

A mathematical analysis is made of the redistribution of solute which occurs during the solidification, without convection, of a single-phase alloy. Calculations of solute distributions are carried out for steady-state conditions, and for the transient changes in solute concentration, both in the solid and in the liquid, which occur at the beginning and end of solidification and as a result of a change in the speed of solidification. The solute distributions in the transient regions are considered for the case of two solutes present in the melt. It is shown that, under certain conditions, p-n junctions may be produced in the transient regions of solidification in germanium or silicon melts containing two suitable solutes. A.

539.231 : 548.5

718. SPUTTERING OF METAL SINGLE CRYSTALS BY ION BOMBARDMENT. G.K.Wehner.
J. appl. Phys., Vol. 26, No. 8, 1056-7 (Aug., 1955).

The patterns obtained when metal single crystals are sputtered are studied and related to the atomic arrangement within the plane from which the sputtering occurs. J.Thewlis

539.234 : 535.345

719. TRANSMISSIVITY OF THIN CARBON FILMS. R.J.Thorn and G.H.Winslow.
J. chem. Phys., Vol. 23, No. 9, 1729-30 (Sept., 1955).

Measurements made of the optical density of carbon films, as a function of the time t of deposition and also of the vaporization temperature T, disagree with theoretical predictions for t less than 18 min, and also for t greater than 70 min, at T = 2424°K. R.A.Weale

539.234 : 535.39

720. STUDY OF THIN METALLIC FILMS BY THE ANALYSIS OF THE ELLIPTICITY OF REFLECTED LIGHT. J.Moret-Bailly.
J. Phys. Radium, Vol. 16, No. 7, 69 S (July, 1955). In French.

Evaporated Al films were studied, using light of wavelength 0.546 micron. Film thicknesses were determined from the mass of Al evaporated. The reflected light was analysed with a modified Chaumont analyser. For thick layers, the refractive index is given as 0.750, and the absorption index 4.88. Layers less than 50 A thick were found to be substantially completely oxidized, whilst for the thicker layers in the range 105—200 A, the properties were almost independent of thickness. D.G.Avery

539.234 : 548.5

721. ON THE CRYSTALLIZATION OF EVAPORATED LAYERS OF ANTIMONY. A.Götzberger.
Z. Phys., Vol. 142, No. 2, 182-200 (1955). In German.

The behaviour of an initially amorphous layer of Sb, evaporated in vacuo on to a glass or metal base, depends on the thickness d of the layer. For d less than 200 A, the Sb remains amorphous, for d between 200 and 2000 A, crystallization occurs gradually and for d greater than 2000 A, crystallization proceeds at an explosive rate. J.Franks

539.27

722. ETCHING BY IONIC ATTACK FOR METALLOGRAPHIC OBSERVATIONS IN THE PHOTOELECTRIC EMISSION MICROSCOPE. E.L.Huguenin and M.Gauzit.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4,378-80 (July 25, 1955). In French.

Three methods of treating the specimen surface within a photoelectric emission microscope are described. Bombardment with an ion gun contaminates the surface except within a central region where etching takes place. Using the surface as cathode in a gas discharge tube gives rise to uniform etching with no contamination. A combination of these two processes allows selective cleaning of the surface to be carried out, which renders separate crystal facets visible by their photoelectric emission. A.E.I.Research Laboratory

ELASTICITY. STRENGTH. RHEOLOGY 539.3/.8

539.31

723. QUANTIZATION IN ELASTIC UNSTABILITY PHENOMENA. J.Naleszkiewicz.
Bull. Acad. Polon. Sci. Cl. 4, Vol. 3, No. 2, 57-70 (1955).

The concepts of "energy-levels" of stable equilibrium configurations of an elastic system, and of "quanta" of energy required to be supplied in order to pass from one stable configuration to another, are useful in analysing possible modes of instability. A systematic analysis is given of the stability of a bar subjected at the ends to simultaneous compression, torsion and bending. J.G.Oldroyd

539.31 : 539.374

724. ON THE BASES OF THE THEORY OF NON-HOMOGENEOUS ELASTO-PLASTIC BODIES. I. W.Olszak.
Bull. Acad. Polon. Sci. Cl. 4, Vol. 3, No. 2, 45-9 (1955).

Bodies are classified broadly according to the type of inhomogeneity in the elastic or the plastic state. J.G.Oldroyd

539.319

725. NOTE ON THE LATENT STRESSES IN PRISMATIC BARS AFTER THERMAL TREATMENT. A.Kammerer.
C.R. Acad. Sci. (Paris), Vol. 241, No. 12, 730-2 (Sept. 19, 1955). In French.

If a bar is heated uniformly through the transition point at which an abrupt increase of density occurs, and then quenched, the residual stresses in the cooled bar may include high tensile stresses near the surface. Analysis of the residual stresses shows that the two non-vanishing principal stresses at the surface are equal. A large curvature in a re-entrant part of the surface has the effect of greatly increasing the residual tension locally near the surface, in accordance with the experimental observation that there is danger of fracture at such points. J.G.Oldroyd

539.319 : 535.55

726. OPTICAL POLARIZATION EXPERIMENTS ON THE ELASTIC IMPACT THEORY OF ST.VENANT AND FLAMANT. H.Schwieger and H.Dietz.
Ann.Phys. (Leipzig), Vol. 16, No. 6-8, 306-21 (1955). In German.

Two rods of rectangular cross-section, one of glass and the other of metal are brought into collision. The stress generated by the impact is measured optically at different places along the glass rod which is held at one end. The theory is given together with experimental details of the method. The results are presented and discussed with reference to the theory. H.G.Jerrard

539.32

727. STATIC AND DYNAMIC MEASUREMENTS OF YOUNG'S MODULUS FOR POROUS MATERIALS. J.Barducci

and R.Cabarat.
Rev. Metall., Vol. 51, No. 3, 149-53 (1954). In French.

Measurements on porous bronze show that for most porosities there is good agreement between the two methods provided that the static value is taken for very small loads. For the loads used in many testing machines, the static value no longer agrees with the dynamic value. The modulus of elasticity diminishes linearly with the density until the density is about 60% of that of the solid metal. A few observations were also made on brass. See also abstract following. J.M.Hough

539.32

728. ON THE APPARENT ELASTIC MODULUS OF POROUS SOLIDS. I.Barducci.
Alluminio, Vol. 23, 261-8 (1954). In Italian.

See preceding abstract. A theoretical account is given on the assumption that there is no interaction between the cavities for both the static and dynamic moduli. This leads to a linear law between elastic modulus and density and to a conclusion that the shape of the cavity will not be important. This is confirmed by the good agreement between the theoretical constant for spheres and the value obtained for porous bronze. J.M.Hough

539.32

729. NEUTRON IRRADIATION EFFECTS UPON YOUNG'S MODULUS AND INTERNAL FRICTION OF COPPER.
D.O. Thompson, D.K. Holmes and T.H. Blewett.
J. appl. Phys., Vol. 26, No. 9, 1188 (Sept., 1955).

The modulus of copper crystals grown from the melt increases by a few percent after neutron fluxes as low as 10^{14} nvt. The decrement, measured at 20 kc/s, decreases sharply on irradiation. The results suggest that the vacancies or interstitials lock dislocations so that they cannot decrease the modulus or contribute to the damping by their motion. W. M. Lomer

539.37 : 548.0

730. DEFORMATION OF AN EXPLOSIVELY LOADED ALUMINIUM SINGLE CRYSTAL. J.S.Rinehart.
J. appl. Phys., Vol. 26, No. 11, 1315-18 (Nov., 1955).

A hollow cylindrical single crystal of pure aluminium was deformed by detonating an explosive charge that had been placed axially within the crystal. The approximate strain rate achieved was 10^5 sec^{-1}. The object of the test was to relate the pattern of deformation to the stresses set up by the explosive and the crystallographic axes of the crystal. The reaction of the cylinder was markedly different from the reaction which would be exhibited by a similarly shaped cylinder of polycrystalline material. The deformation was non-uniform with both the fracturing and the plastic flow exhibiting a two-fold symmetry that could be unambiguously related to the orientation of stress with respect to the crystallographic axes and their associated slip systems. A.

539.373

731. PERMANENT DEFORMATIONS OF POLYCRYSTALLINE SOLIDS AFTER EXPOSURE TO HIGH HYDROSTATIC PRESSURE. Haï Vu. and P. Johannin.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 565-6 (Aug. 8, 1955). In French.

Samples of Zn, Cd, and Al were photomicrographed before and after hydrostatic compression (up to 9000 atm). The first two, of hexagonal structure, are deformed, the latter, of cubic structure, is not. F. Ansbacher

539.373

732. INTERACTION BETWEEN SLIP BANDS AND PARTICLES OF PRECIPITATE IN AN ALUMINIUM ALLOY.
S.Koda and T.Takeyama.
J. Phys. Soc. Japan, Vol. 10, No. 9, 822-3 (Sept., 1955).

Electron micrographs show that the slip bands bend the particles of precipitate in passing through them. Some measurements on the fine structure of the bands, i.e. the step and slip distance, are quoted. A.J.Kennedy

539.373

733. SLIP IN THE INTERIOR OF ALUMINIUM-SILVER SINGLE CRYSTALS. N.A.McKinnon.
Phil. Mag., Vol. 46, 1150-2 (Oct., 1955).

Slip in the interior of single crystals of Al with 3.8 wt.% Ag can be detected after a mild ageing treatment followed by etching. Only the coarse slip lines have been detected, but cross-slip is seen in crystals in suitable orientation. There is no evidence of dislocation pile-up on slip systems other than the primary. W.M.Lomer

539.373 : 539.385

734. FLEXURAL ROTATIONAL SLIP AS THE MAIN DEFORMATION PROCESS IN THE TORSION OF ZINC CRYSTALS.
A.D. Whapham and H. Wilman.
Nature (London), Vol. 176, 460-61 (Sept. 3, 1955).

It is shown that rotational slip on (0001) is the main deformation process in twisted crystals of Zn even when the axis of torsion is 60° from the [0001] direction. Macroscopic flexures of the slip lamellae are revealed by cleavage. W. M. Lomer

539.373 : 539.67

735. THE MECHANISM OF INTERNAL FRICTION DUE TO THE MOTION OF THE DISLOCATION. T.Hirone, N.Kunitomi and M.Abe.
J. Phys. Soc. Japan, Vol. 10, No. 11, 960-6 (Nov., 1955).

This was studied by measurements of the variation of internal friction with cold-work. For copper, internal friction increases with the initial cold-work and decreases after showing a maximum. Since the behaviour does not depend on the frequency used in the experiment at room temperatures, internal friction due to dislocations is concluded to originate from the static hysteresis proposed by Nowick. A.

539.374

736. ON THE PROBLEM OF STRESS RELIEF WITH CONSTANT FLOW LIMIT IN THE ORIGIN OF INTERNAL STRESSES. H.Schlechtweg.
Naturwissenschaften, Vol. 42, No. 14, 410-11 (1955). In German.

It is pointed out that if the flow stress is regarded as constant during unloading under conditions where a finite region of the body is plastic, some flow with stress relief may occur by plastic flow as the region collapses. In the specific case of a thick spherical shell under internal pressure, it is found that no stress relief comes from this cause. It cannot be concluded that this is generally so. W.M.Lomer

539.374

737. THE APPARENT STRENGTH OF EXTENSIVELY CRACKED MATERIALS. D.J. Millard, P.C. Newman and J.W. Phillips.
Proc. Phys. Soc. B, Vol. 68, Pt 10, 723-8 (Oct., 1955).

Coal specimens having weights within the range 10^{-9}-10^{3} g were broken in crushing tests. The crushing loads were found to vary as the half power of specimen weight, instead of the two-thirds power predicted by simple dimensional analysis. A theory is proposed to account for these facts and this theory is used to provide an estimate of the rupture energy for one coal (Llandebie). The value of energy obtained, 3.0×10^4 erg.cm^{-2}, seems to indicate that plastic deformation is occurring in this coal which is normally considered completely elastic. The occurrence of plastic flow in very small particles of any coal under similar conditions of loading is a logical sequence of the theory. This plastic flow has been observed in two of the coals used in this work. A.

539.4.011.22

738. ON THE THERMIC MEASUREMENT OF THE ELASTIC LIMIT IN METALS. F.Jager.
J. Phys. Radium, Vol. 16, No. 10, 812 (Oct., 1955). In French.

It is proposed to record the variations of temperature of a tensile test specimen in vacuo (correct to 0.001^0, say) as the tension is increased. A sharp change is expected, at the elastic limit, from a predictable decrease of temperature at each increase of load in the elastic range, to a heating of the specimen due to internal friction at each increase of load beyond the elastic limit. J.G.Oldroyd

539.4.013

739. ON THE PROBABILITY LAW FOR THE (MECHANICAL) RESISTANCE OF AN IDEAL PLASTIC SPECIMEN. M. Davin.
C.R. Acad. Sci. (Paris), Vol. 241, No. 2, 156-8 (July 11, 1955). In French.

Continuation of previous work (Abstr. 1789/1954) in which a specimen is regarded as being made up of elements whose strengths are random variables. R.O. Davies

539.4.016.2 : 539.26

740. SMALL-ANGLE X-RAY SCATTERING FROM PRECIPITATES IN COLD-WORKED Al–Ag AND Al–Zn. J.P.Jan.
J. appl. Phys., Vol. 26, No. 11, 1291-7 (Nov., 1955).

A study of aging in cold-worked Al–Ag and Al–Zn alloys during the first stage of precipitation was made, by means of small-angle X-ray scattering. (a) The rate of growth of the Ag or Zn clusters was very little affected by cold-work. (b) Evidence was found that the amount of clustered solute is not altered by aging. (c) The clusters were deformed by cold-work, giving rise to an anisotropic small-angle scattering. This cannot be explained by large amounts of glide taking place in a limited number of slip planes, but rather speaks in favour of zones of homogeneous deformation. The deformation of precipitated particles by cold-work is a new and powerful means of investigating the mechanism of plastic deformation in the interior of a material. A.

539.4.016.3

741. STUDY OF THE INITIAL STAGES OF SINTERING SOLIDS BY VISCOUS FLOW, EVAPORATION-CONDENSATION, AND SELF-DIFFUSION. W.D.Kingery and M.Berg.
J. appl. Phys., Vol. 26, No. 10, 1205-13 (Oct., 1955).

The mechanism of material transport in sintering can be elucidated in some cases by direct observation of the rate of interface growth and approach of centres between spherical particles. Measurements with glass, sodium chloride, and copper indicate that with these materials viscous flow, evaporation-condensation, and self-diffusion are the rate-determining mechanisms. Values of viscosity, vapour pressure, and diffusion constants have been determined, but calculations of diffusion constants from these data are subject to uncertainties of interpretation, A model is presented for the behaviour of copper during the initial stages of sintering, which is in agreement with available experimental data, and which requires vacancy elimination at dislocations or grain boundaries. Data for refractory oxides indicate the importance of purity and fabrication pressure, but the sintering mechanism for these materials is not determined by the present data. A.

539.434

742. THEORY OF STEADY-STATE CREEP BASED ON DISLOCATION CLIMB. J.Weertman.
J. appl. Phys., Vol. 26, No. 10, 1213-17 (Oct., 1955).

A theory of steady-state creep is developed using Mott's mechanism of dislocation climb. It is assumed in the analysis that the rate-controlling process is the diffusion of vacancies between dislocations which are creating vacancies and those which are destroying them. The concentration of vacancies along a dislocation line is determined by setting the change in the free energy caused by a decrease or increase in the number of vacancies equal to the change in the elastic energy occuring during dislocation climb. The creep equation that results from the analysis is:

$$\text{creep rate} = \text{const}\,(\sigma^{\alpha}/kT)\exp(-Q/kT)$$

where α is a constant (about 3 or 4), Q is the activation energy of self-diffusion, kT has its usual meaning, and σ is the stress. This equation is valid in the stress range from the critical shear stress to a stress about equal to 10^8–10^9 dynes/cm^2. At larger stresses the creep rate increases much more rapidly with stress. A.

539.531

743. STRAIN-HARDENING OF A METAL BY LAMINAR OR TURBULENT FLOW. W.A.Wood.
Phil. Mag., Vol. 46, 1028-30 (Sept., 1955).

The effects of tensile testing and of fatigue testing on X-ray patterns and recrystallization temperatures are compared, and the recovery of pairs of specimens hardened to the same degree is studied. Tensile testing gives turbulent flow, and the associated hardening and disorientations are removed only on recrystallization. Fatigue tests give laminar flow with only small disorientations, and strain hardening disappears before recrystallization, which occurs at much higher temperatures. An interpretation of this in terms of the different dislocation structures is given. W.M.Lomer

539.56

744. EMBRITTLEMENT OF TUNGSTEN WIRE. B. Thomson.
Nature (London), Vol. 176, 360 (Aug. 20, 1955).

Very slight surface contamination of the tungsten by nickel is a major source of embrittlement. The use of nickel formers, nickel alloy spools or winding over nickel rollers will contribute sufficient Ni to embrittle the wire. It is believed that Fe produces a slight effect. A. H. W. Beck

539.61

745. PROBLEMS OF ADHESION. N.N.Winogradoff; B.V.Deryagin.
Research, Vol. 8, No. 9, 365 (Sept., 1955).

Winogradoff questions the electron path indicated in one of the figures of Deryagin's paper (Abstr. 7446/1955). In reply Deryagin states that the electron will only follow the lines of force provided five conditions are fulfilled. He then indicates how this is not so in his experiments. T.C.Toye

539.61

746. THEORY OF ADHESION. W. G. Cass.
Nature (London), Vol. 176, 495-8 (Sept. 10, 1955).

539.67

747. EFFECT OF HEAT TREATMENT ON THE INTERNAL FRICTION OF ALUMINIUM CRYSTALS. M. Levy and M.Metzger.
Phil. Mag., Vol. 46, 1021-5 (Sept., 1955).

The internal friction in quenched Al crystals at strain amplitudes 10^{-5} to 10^{-6} is much lower than in similar slowly cooled crystals. Strain from the thermal shock would be expected to increase the decrement; in fact, higher initial temperature, faster quenching and longer rest at room temperature before test all decrease the decrement. The results are in broad agreement with estimates of the effects expected of vacancies being trapped at dislocations. W.M.Lomer

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM. CHEMICAL REACTIONS 541.11/.12

541.123.2

748. THE SYSTEM OZONE-OXYGEN. A.C.Jenkins, F.S.DiPaolo and C.M.Birdsall.
J. chem. Phys., Vol. 23, No. 11, 2049-54 (Nov., 1955).

At temperatures below -180^0 C liquid ozone and liquid oxygen are not miscible in all proportions. Two liquid phases occur over a definite range in composition which depends upon the temperature. The solubility diagram at saturation pressures has been determined experimentally by measuring vapour pressure v. composition isotherms at -183.0^0 C, -185.7^0 C and -195.6^0 C. The upper or oxygen-rich liquid phase has been analysed at -181.9^0 C, -182.9^0 C, -186.0^0 C and -195.6^0 C. The critical solution temperature is -179.9^0 C $\pm$ 0.5^0 C. A liquid-vapour equilibrium diagram at one atmosphere total pressure has also been determined experimentally. A.

541.124

749. FREE-ELECTRON TREATMENT OF DIELS–ALDER'S REACTION. S. Basu.
J. chem. Phys., Vol. 23, No. 8, 1548-9 (Aug., 1955).

The relative ease of formation of the maleic anhydride addition product has been deduced for eight aromatic hydrocarbons from calculations of the para localization energy. These calculated rate constants are in the right sequence with the experimental results. G. I. W. Llewelyn

541.124.7 : 537.525.72

750. DISSOCIATION OF WATER VAPOR IN ELECTRIC DISCHARGE. E.A.Secco.
J. chem. Phys., Vol. 23, No. 9, 1734 (Sept., 1955).

It is suggested that the energy (430 k cal.) found (Giguère, Secco and Eaton, 1953) to be required to dissociate water in a high-frequency electrodeless discharge may be accounted for by either or both of the following reactions:
(1) $H_2O + e \rightarrow H + OH^+ + 2e$; (2) $H_2O + e \rightarrow OH + H^+ + 2e$.
W.Good

541.126

751. REACTION OF METHYL RADICALS WITH NITRIC OXIDE. W.A.Bryce and K.U.Ingold.
J. chem. Phys., Vol. 23, No. 10, 1968 (Oct., 1955).

Direct reaction between CH_3 and NO (reaction time of 5×10^{-2} sec) yielded a wide range of reaction products with a (mass-spectrometer) peak at 45 for CH_3NO. By reducing the reaction time and increasing temperature, the yield of CH_3NO was highly increased. Collision efficiencies and rate constants are given for the reaction times of 1.2×10^{-4} and 4×10^{-4} sec and temperatures of 900^0 C and 480^0 C, respectively.
F.Lachman

541.126 : 536.46

752. STEADY-STATE BURNING OF A LIQUID DROPLET. I. MONOPROPELLANT FLAME. J.Lorell and H.Wise.
J. chem. Phys., Vol. 23, No. 10, 1928-32 (Oct., 1955).

The flame equations corresponding to the steady-state combustion of a liquid droplet are presented and adapted to the case of a monopropellant system with chemical reaction diffused throughout the gas phase. The theoretical analysis is applied to the case of a liquid hydrazine monopropellant flame. A.

541.127

753. SPACE-TIME YIELD AND REACTION RATE. G. J. Janz and S. C. Wait, Jr.
J. chem. Phys., Vol. 23, No. 8, 1550-1 (Aug., 1955).

Space-time-yield (S. T. Y.), defined as the quantity of product per unit volume per unit time, is a useful concept in the study of gaseous reactions in continuous flow systems. It is shown that the S. T. Y. is directly proportional to the rate constant for both first-order and second-order reactions, if it is measured under comparable conditions in the region of small conversions for two similar processes. S. J. Gregg

541.127

754. ANHARMONICITY AND MONOMOLECULAR REACTIONS. R.H.Tredgold.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 920-3 (Oct., 1955).

A theoretical expression for the anharmonicity is found for the case of bodies of unit mass moving in a straight line. It is suggested that the effect of anharmonicity will make a large difference to the reaction rate at low pressures.
C.Turner

541.127.4

755. DETERMINATION OF EQUILIBRIUM CONSTANT OF THE REACTION BETWEEN BF_3 AND BCl_3. T.H.S.Higgins, E.C.Liesegang, C.J.G.Raw and A.S.Rossouw.
J. chem. Phys., Vol. 23, No. 8, 1544 (Aug., 1955).

The equilibrium constant $K = (BFCl_2)\ (BF_2Cl)/(BF_3)\ (BCl_3)$ has been measured using an infrared absorption spectrometer. Equilibrium was established in 30 min at 27^0 C and $K = 0.53 \pm 0.04$, i.e. in an equimolecular mixture of BCl_3 and BF_3 approx. 42% is converted into the mixed halides.
S.J.Gregg

541.128

756. IRON-CATALYZED REACTION BETWEEN NITROSYL DISULFONATE AND HYDROXYLAMINE MONOSULFONATE IONS. W.J.Ramsey and D.M.Yost.
J. chem. Phys., Vol. 23, No. 11, 2153-9 (Nov., 1955).

An investigation of the kinetics of the iron-catalyzed reaction between the purple-coloured, paramagnetic nitrosyl disulphonate ($ON(SO_3)_2^=$) ions and hydroxylamine monosulphonate ($HONHSO_3^-$) ions. See Abstr. 7237 (1953). A.

ELECTROCHEMISTRY 541.13

541.134 : 536.7

757. BRØNSTED'S WORK PRINCIPLE AND GIBBS' TREATMENT OF ELECTROMOTIVE FORCE. D. MacRae.
J. phys. Chem., Vol. 59, No. 8, 797-8 (Aug., 1955).

It is shown that the derivation of well-known relations, such as that between the e. m. f. of a cell and the chemical potential of the ion involved, is simplified by applications of the principle. W. Good

541.135

758. THE "HUMP" IN THE CAPACITY OF THE ELECTRICAL DOUBLE LAYER. D.C.Grahame.
J. chem. Phys., Vol. 23, No. 9, 1725-6 (Sept., 1955).

The existence of a quasi-crystalline layer of water molecules a few molecules thick is postulated, and used to explain the form of the curves showing, at different constant temperatures, the variation with polarization potential of the capacity of the double layer. W.Good

541.135.5

759. ON THE EVALUATION OF THE CONCENTRATION POLARISATION AND THE POTENTIAL FALL IN THE DIFFUSION LAYER BY CATHODIC POLARISATION. E.Budewski and J.Malinowski.
C.R. Acad. Bulg. Sci., Vol. 4, No. 1, 9-12 (Jan.-March,

1951).

This is done theoretically for an electrode system in which the solution contains not only the salt taking part in the electrode process but also a finite amount of an indifferent electrolyte. W.Good

541.136

760. CONCERNING THE TEMPERATURE COEFFICIENT OF THE E.M.F. OF REVERSIBLE GALVANIC CELLS OPERATED AT VARIABLE CONCENTRATION. II. J.C.M.Li.
J. chem. Phys., Vol. 23, No. 11, 2012-13 (Nov., 1955).

For previous part, see Abstr. 8299 (1951). The general expression including concentration coefficients of the e.m.f. of the cell is derived for an open system. The limitation in the application of the Gibbs—Helmholtz equation is further discussed in general with additional examples. A.

PHOTOCHEMISTRY. RADIATION CHEMISTRY 541.14/.15

541.14

761. CHEMICAL AND PHOTOCHEMICAL STUDIES ON 6, 8-THIOCTIC ACID AND 1, 2-DITHIOLANE (TRIMETHYLENE DISULFIDE). R.B.Whitney and M.Calvin.
J. chem. Phys., Vol. 23, No. 10, 1750-6 (Oct., 1955).

Quantum yields have been determined in the photolysis by ultraviolet light under a variety of conditions. The order of magnitude of the quantum yield is unity. A.

541.15

762. CHEMICAL DOSIMETRY OF FAST ELECTRONS (15 MeV). G.Breitling, R.Glocker and S.Rösinger.
Naturwissenschaften, Vol. 42, No. 18, 507-8 (1955). In German.

Doses delivered by a beam of 200 kV X-rays or by electrons of 3 MeV and 15 MeV energy were measured by the fluorescence produced in an air-equivalent crystalline material (a), and by the ionization produced in air (b). The ratio of a/b decreased steadily to unity in the energy range of electrons 3 MeV to 15 MeV. Dosimetry was also carried out with dilute aqueous solutions of $FeSO_4$ containing small amounts of butanol. The amount of ferric formed by about 300 r of 200 kV X-radiation could be estimated spectrophotometrically after the addition of KSCN and acetone. The ratio a/b for 15 MeV electrons was the same as for 200 kV X-rays. Theoretically it should have been lower by 2%. The ratio of the 15 MeV electron doses measured either chemically or by ionization in air, was 3% lower than that for 200 kV X-rays. Theoretically it should have been 4% lower. M.Ebert

541.15

763. THE CHEMICAL EFFECTS OF IONISING RADIATION IN SOLIDS. II. H.G.Heal.
Atomics (London), Vol. 6, No. 8, 241-7 (Aug., 1955).

In this second part of a review article (see Abstr. 8360/1955 for Pt I) the published work on simple ionic crystals, crystals containing complex ions, inorganic molecular crystals and organic solids is surveyed. C.B.Allsopp

541.15

764. EFFECT OF PROTON IRRADIATION UPON THE ELECTRODE POTENTIAL OF TUNGSTEN. M.Simnad and R.Smoluchowski.
Phys. Rev., Vol. 99, No. 6, 1891-2 (Sept. 15, 1955).

The irradiated specimens were found to be anodic to (less noble than) the annealed specimens, irradiation therefore making the tungsten more reactive chemically. It is suggested that the change of electrode potential is associated with the production of localized lattice imperfections at the metallic surface. W.Good

541.15

765. EFFECT OF PROTON IRRADIATION UPON THE RATE OF SOLUTION OF Fe_2O_3 IN HYDROCHLORIC ACID. M.Simnad and R.Smoluchowski.
J. chem. Phys., Vol. 23, No. 10, 1961-2 (Oct., 1955).

The oxide specimens were irradiated with 260 MeV protons of a total flux of 10^{16} protons per cm^2. The rate of solution of the oxides in hydrochloric acid is thereby significantly increased. W.Good

541.15

766. REDUCTION OF RIBOFLAVIN TO A STABLE FREE RADICAL USING X-RAYS. A.J.Swallow.
Nature (London), Vol. 176, 793-4 (Oct. 22, 1955).

Air-free solutions of 10^{-4} M riboflavin in 2 N H_2SO_4 containing 5 x 10^{-1} M ethyl alcohol were exposed to 16 000 r 190 kVp X-irradiation. The yellow solution turned red and showed the same absorption spectrum as the stable semiquinone free radical made chemically by reduction. On admission of air the yellow colour of the solution was reconstituted. 95-100% of the riboflavin can be reduced by radiation to the free radical with a yield of G = 6.6 molecules changed per 100 eV of radiation energy absorbed. The probable reaction mechanism involves free hydroxyethyl radicals. The author believes the semiquinone to be the first radiation-produced stable free radical in solution. M.Ebert

DISPERSIONS. COLLOIDS. ADSORPTIOI 541.18

541.183

767. DETERMINATION OF ADSORPTION ENERGY HETEROGENEITY OF SOLID SURFACES. J.M.Honig.
J. chem. Phys., Vol. 23, No. 8, 1557-8 (Aug., 1955).

Mathematical. It is shown that, contrary to an earlier assumption, two of the equations of a previous paper (Abstr. 7831/1954) are not independent. S.J.Gregg

541.183

768. INFRARED STUDY OF THE ADSORPTION ON SILICA GEL. T.Yoshino.
J. chem. Phys., Vol. 23, No. 8, 1564-5 (Aug., 1955).

The infrared absorption bands of 1, 2 dichloroethane (I) and of acetylacetone (II) adsorbed on silica gel, have been measured. For (II) the bands were measured also for 1.5% chloroform solution, the pure liquid, and the liquid saturated with water. It is concluded that the surroundings of the adsorbed molecules may be similar to those of the molecules when dissolved in highly polar solvents. S.J.Gregg

541.183

769. MOBILITY OF HYDROGEN ON TUNGSTEN. R.Gomer and R.Wortman.
J. chem. Phys., Vol. 23, No. 9, 1741-2 (Sept., 1955).

The mobility has been studied by a field-emission technique. For values of θ much greater than 1, evidence has been obtained for the mobility of physically adsorbed hydrogen on top of the chemisorbed layer at temperatures less than 20°K (θ = fraction of surface covered). For θ much less than 1, activated diffusion sets in at 230°K, with an activation energy 0.21 times the heat of evaporation of atomic H. Desorption is complete at 60°K. S.J.Gregg

541.183

770. USE OF INTERPOLATION THEORY IN THE ANALYSIS OF GAS ADSORPTION ISOTHERMS. II. ESTIMATION OF CERTAIN PARAMETERS. J.M.Honig and P.C.Rosenbloom.
J. chem. Phys., Vol. 23, No. 11, 2179-82 (Nov., 1955).

For Pt I, see Abstr. 5057 (1955). In an extension of the interpolation theory described elsewhere, upper and lower

bounds have been placed on a number of physical quantities of interest in adsorption theory. A.

541.183.26

771. STATE OF NITROGEN ADSORBED ON TUNGSTEN. G. Ehrlich.
J. chem. Phys., Vol. 23, No. 8, 1543-4 (Aug., 1955).

On heating a tungsten filament kept for time t in very dilute N_2 (about 10^{-7} mm Hg) the adsorbed gas comes off in two temp. ranges: (α) below 800°K, and (β) below 2000°K. The number of molecules in state β increases monotonously with t, but in state α it passes through a maximum. α may indicate a surface complex with a N_2 "molecule" bound to the W through π electrons, with the σ orbital bonding the N atoms. The nature of α is not established; but it seems that at least three levels of interaction are involved in the adsorption of N_2 on a sparsely covered W surface. S. J. Gregg

541.183.26

772. GAS ADSORPTION ON HETEROGENEOUS SURFACES. L.G.Hepler.
J. chem. Phys., Vol. 23, No. 11, 2110-11 (Nov., 1955).

The mathematical treatment of the adsorption of gas on nonuniform surfaces has been investigated with respect to the proper limits for the integration of the isotherm equation. The physical significance of these limits is discussed. Equations that relate the distribution of energy sites over the surface and the heat of adsorption are derived. A.

541.183.5 : 536.75

THERMODYNAMIC PROPERTIES OF KRYPTON ADSORBED ON TITANIUM DIOXIDE (RUTILE). See Abstr. 303.

CHEMICAL STRUCTURE 541.2/.6

541.64 : 538.22

773. MAGNETOCHEMICAL STUDY OF ANTHRACENIC PHOTOPOLYMERS. R. Calas, J. Hoarau, R. Lalande and A. Pacault.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 407-8 (July 25, 1955). In French.

The diamagnetic molar susceptibilities of anthracene and meso-substituted anthracene derivatives have been determined. Dimerization is induced by exposure to ultraviolet radiation, and measurements carried out on the dimeric forms of these compounds indicate a considerable decrease in the diamagnetism on polymerization. G. I. W. Llewelyn

541.67

774. CALCULATION OF THE MAGNETIC SUSCEPTIBILITY OF σ BONDS. APPLICATION TO THE BONDS C–C, C–H, TO SATURATED HYDROCARBONS AND TO THE CH_2 RADICAL. J. Guy and J. Tillieu.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 382-5 (July 25, 1955). In French.

Previous work by Slater and Coulson (1937) is developed to yield a mathematical expression for the magnetic susceptibility of bonds and molecules. G. I. W. Llewelyn

541.67 : 538.22

775. MAGNETIC SUSCEPTIBILITIES OF SOME URANIUM (IV) COUMPOUNDS. C.A.Hutchison, Jr and C.M.Herzfeld.
J. chem. Phys., Vol. 23, No. 9, 1650-5 (Sept., 1955).

The magnetic susceptibilities of $U(SO_4)_2 \cdot 4.22\,H_2O$, $U(C_2O_4)_2 \cdot 6\,H_2O$, $UF_4 \cdot NaF$, (γ)$UF_4 \cdot 2\,NaF$ and $UF_4 \cdot 3\,NaF$ have been measured in the temperature range from 14°K to 300°K. The results are presented in graphical form and their general form is discussed. The susceptibilities of all five compounds appear to approach finite values at 0°K. A.

CHEMICAL ANALYSIS 543/545

545.827

776. RAPID GAS ANALYZER USING IONIZATION BY ALPHA PARTICLES. P. F. Deisler, Jr, K. W. McHenry, Jr and R. H. Wilhelm.
Analyt. Chem., Vol. 27, No. 9, 1366-74 (Sept., 1955).

A method and apparatus are presented for analysis of a flowing or quiescent gaseous mixture, by means of ionization of the mixture using alpha-particles from polonium in an aged radium D source. By utilizing a proper combination of applied voltage and electrode spacing in the ionized mixture, ionization currents of the order of 10^{-8} A are obtained. The current depends in its precise value on the composition of the gas (binary, ternary, and possibly more components) at constant temperature and pressure. Primary calibration is necessary with recalibration or compensation at intervals, because of radioactive decay of the source (half-life, 22 years). Electrical output may be recorded by a variety of devices or used in control systems. Binary systems: H_2–N_2, H_2–C_2H_4, C_2H_4–C_2H_6 and N_2–CO_2, and the ternary: N_2–H_2–C_2H_6 have been analysed satisfactorily. In principle, gases of different molecular, atomic, or electronic structure should be capable of differentiation, examples of exceptions thus being ortho H_2-para H_2 and H_2–D_2. Theoretical time of response is of the order of 10^{-3} sec; precision of analysis in the prototype apparatus was about 0.2 to 0.3 mole % for binary mixtures. A.

545.827 : 539.172.4

777. HOW TO MINIMIZE ERRORS IN NEUTRON ACTIVATION ANALYSIS. R.C.Plumb and J.E.Lewis.
Nucleonics, Vol. 13, No. 8, 42-6 (Aug., 1955).

Errors in the actual measurement of the activity produced may arise as a result of incomplete chemical separation of the activity sought, production of given activities by transmutation of other elements present, neutron-flux variations in the regio of the sample, and self-shielding within the sample. Possible methods of avoiding these sources of error are discussed. L.R.Shepherd

CRYSTALLOGRAPHY 548

548.33

778. ON THE COINCIDENCE OF FUSION POINTS IN THE POLYMORPHS OF DIBENZOYLMETHANE AND OF ITS ENOL-ETHERS. Y. Urushibara, F. Iimura and K. Ikeda.
J. chem. Phys., Vol. 23, No. 9, 1724-5 (Sept., 1955).

Cis—trans relationships in these compounds showing coincident fusion points, mixed crystals and the classification of the polymorphs are discussed. W. Good

548.5

779. INFLUENCE OF THE MEDIUM OF GROWTH ON THE CORRESPONDENCE BETWEEN MORPHOLOGY AND CRYSTALLINE STRUCTURE. I. INTERACTION BETWEEN THE CRYSTAL AND SOLVENT. R. Kern.
Bull. Soc. Franç. Minéral. Crist., Vol. 78, No. 7-9, 461-74 (July-Sept., 1955). In French.

Reviews briefly the theoretical aspect of crystal morphology and emphasizes that for experimental verification observations on natural crystals do not suffice, but that the growth conditions both internal and external to the crystal are important. In particular, the effect of the solvent is discussed. S. Weintroub

548.5

780. NUCLEATION OF LEAD WITH PREFERRED ORIENTATION. H. A. Atwater and B. Chalmers.
J. appl. Phys., Vol. 26, No. 7, 918-19 (July); Erratum, No. 10, 1284 (Oct., 1955).

Lead of high purity was allowed to cool from melt in a graphite crucible so that solidification started on the free surface; a single crystal was obtained with the 111 plane parallel to the surface. Slightly impure lead gave a polycrystalline mass with strong preferred orientation in the same direction. A. R. Stokes

548.5

781. "SPIRAL POLYGON" TIN WHISKERS. P. W. Levy and O. F. Kammerer.
J. appl. Phys., Vol. 26, No. 9, 1182-3 (Sept., 1955).

Tin whiskers grown from edges of a compressed stack of tin plate sometimes form spiral polygons; growth and bending occurs at the base. The angles between the sides of the polygons are mainly within $25^0 - 35^0$; bending may be due to a twinning process. J. Franks

548.5 : 539.4.016.3

782. PRECIPITATION OF COPPER IN GERMANIUM. R.A. Logan.
Phys. Rev., Vol. 100, No. 2, 615-17 (Oct. 15, 1955).

The density of dislocations is shown to have a marked effect on the rate of anneal of copper in germanium. At 500^0 C samples containing high dislocation density (about $10^6/cm^2$) anneal in about 1 hour in contrast to material of low dislocation density (about $10^4/cm^2$) which requires about 24 hours. When copper-doped germanium is cooled from a high temperature in regions of high dislocation density, significant precipitation occurs in a cooling cycle of only a few seconds. In this case, in order to prevent precipitation the sample must be quenched from the high temperature in a time of the order of 0.1 second. A.

548.5 : 541.135.5

783. EXCESS VOLTAGE AND SPIRAL GROWTH FRONTS DURING THE ELECTROLYTIC CRYSTALLIZATION OF SILVER. R. Kaischew, E. Budewski and J. Malinowski.
Z. phys. Chem. (Leipzig), Vol. 204, No. 5-6, 348-56 (Aug., 1955). In German.

Growth spirals were observed on the (100) and (110) planes of single crystal Ag cathodes during the electrolytic deposition of Ag. The excess voltage of deposition was shown to be inversely proportional to the distance between the spiral turns and was about 0.1 mV, too small to be measured directly. J. Franks

548.5 : 548.7

784. SCREW DISLOCATIONS AND POLYTYPISM OF CADMIUM IODIDE. R.S. Mitchell.
Phil. Mag., Vol. 46, 1141-6 (Oct., 1955).

See Abstr. 617 (1955). The structures of a number of additional polytypes have been determined, and these confirm Forty's theory (Abstr. 4736/1952) that polytypism in Cd I is due to screw dislocations. A.R. Stokes

548.52

785. HEXAGONAL MICROSTRUCTURE OF ICE CRYSTALS GROWN FROM THE MELT. F.K. Truby.
J. appl. Phys., Vol. 26, No. 12, 1416-20 (Dec., 1955).

Electron microscopy of etched and nascent surfaces of single ice crystals shows a characteristic microstructure of elongated, hexagonal prisms. The small hexagonal units vary greatly in size with an expected width of the order of 3 microns and a length of 6 microns. The coordination among microcrystalline units characterizes a particular single crystal, the size of which may be determined by processes of freezing and subsequent history, but the sizes of the microcrystalline units of which they are composed appear to be independent of the rates of freezing. The etched surfaces show that the centre of the hexagonal unit etches to a greater depth than does the outer area, indicating a higher degree of crystal disorder along the axis of symmetry. Ice surfaces in process of growing from the melt also appear to consist of hexagonal pyramidal pits which are built up by concentric steps around the C-axis. This structure appears to be consistent with that of the etched surfaces. Observations of growing-ice surfaces formed from caesium fluoride solutions reveal that the fluoride impurity tends to reduce the prominence of the pyramidal microstructure in a manner dependent upon concentrations such that the structure disappears for concentrations greater than 10^{-3} M. A.

548.57

786. SHAPE AND CRYSTAL ANISOTROPY OF ALNICO 5. E. A. Nesbitt and H. J. Williams.
J. appl. Phys., Vol. 26, No. 10, 1217-21 (Oct., 1955).

It is concluded from torque measurements on single crystals of Alnico 5 that the high coercive force of these crystals depends upon the shape anisotropy of the fine precipitated pletes and that the crystal anisotropy of the plates is negligible. The present physical picture of the alloy is that it consists of plates of precipitate of high magnetic saturation separated by a matrix of comparatively low magnetic saturation. The plates are made up of rods of precipitate (approximately 75 A diameter x 400 long) but they act magnetically like single domain plates. The magnetization vector turns in the plane of the plates, and it is the length-to-width dimension ratio of the plates which determines the effective shape anisotropy and the resulting coercive force of the alloy. A.

ATOMIC AND X-RAY CRYSTALLOGRAPHY 548.7

548.7

787. HOW ARE THE COEFFICIENTS OF THE LATTICE-ENERGY TERMS INFLUENCED BY THE ACCUMULATION OF IONS OF THE SAME SIGN ON THE SURFACE OF NEUTRAL IONIC LATTICES? I. GENERAL SURVEY. O. Emersleben.

Z. phys. Chem. (Leipzig), Vol. 204, No. 1-2, 121-30 (Feb., 1955). In German.

Two space lattices (NaCl and CsCl types) are compared, and the lattice-energy term which is proportional to volume (in CsCl cubes) is discussed. Two planar lattices (square and "rhombic" elements of an alternating network plane) are next compared. It is found that, if the boundary elements (faces or edges) consist exclusively or predominantly of charges of the same sign, then, when the finite neutral ionic lattices are represented additively by superposition of the volume, face, edge, and coign energies, one has to take into account (also additively) the internal lattice energy of these charges. Relationships developed for the electrostatic portion of lattice energy cannot be found for the non-electrostatic portion of the central forces in lattices where the convergence with distance considerably exceeds 1/r. Reference is made to nine papers of the author (see Abstr. 6167/1952). F.Lachman

548.7

788. RATE OF CONVERGENCE OF MADELUNG SERIES BY THE METHOD OF BERTAUT. D.H.Templeton.
J. chem. Phys., Vol. 23, No. 9, 1629-30 (Sept., 1955).

A calculation is made of the correction to be applied to the Madelung constant when computed by a method given by Bertaut with a finite number of terms. See Abstract 5775 (1953). A.

548.7

789. THERMAL AGITATION OF ATOMS IN CRYSTALS AND THE SCATTERING OF X-RAYS: THE CASE OF SODIUM. H. Curien.
J. Phys. Radium, Vol. 16, No. 7, 44 S - 45 S (July, 1955). In French.

Sodium at room temperature is an example of a crystal in which incident photons are scattered with exchange of energy with two or more modes of oscillation of the crystal simultaneously, and the first-order theory is accordingly found to be inadequate. See also Abstr. 8556, 9160 (1952). A. R. Stokes

548.7

790. ON THE FREQUENCY SPECTRUM OF A CRYSTAL ARRAY. AN APPROXIMATE METHOD OF SOLVING THE INTEGRAL EQUATION FOR THE FREQUENCY SPECTRUM. J.Peretti.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 544-6 (Aug. 8, 1955). In French.

The spectral density $g(\omega)$ of the characteristic (angular) frequencies ω_α may be shown to be a solution of the Fredholm integral equation

$$\mathcal{F}(z) = \int_{-\infty}^{+\infty} g(\omega)/(z-\omega)\ d\omega,$$

where $\mathcal{F}(z)$ is defined by the crystal coefficients. A method of solving this equation is proposed which is essentially based on that adopted by Montroll (Abstr. 3724/1947) but offers advantages in computing high-order terms. The method is said to be shorter thanl solving the Stieltjes equation by the Paley and Wiener formula. A.J.Kennedy

548.7

791. COMPUTATION OF MEAN DEBYE TEMPERATURE OF CUBIC CRYSTALS FROM ELASTIC CONSTANTS. II. P.M.Sutton.
Phys. Rev., Vol. 99, No. 6, 1826-30 (Sept. 15, 1955).

Pt I (Abstr. 418/1954)presented, in an array of equations, an improved, accurate method for computing the mean Debye characteristic temperature of cubic crystals from the elastic constants. The present paper gives an equivalent, simplified, explicit equation. The pertinent integral is also expanded in a Taylor's series to the fifth term by a special device and a method of getting the general term made evident. The first two terms of this series constitute Born's equation which is shown to be usually inaccurate since the series is slowly convergent. This series is useful, however, in estimating the correction to the simple equation first mentioned. This correction is analysed in more detail and extended to values of the anisotropy factor less than unity. Graphs are given permitting rapid calculation of Debye temperatures with an uncertainty due to the approximation made in the method of about 0.1%. A.

548.7

792. EFFECT OF DEFECTS ON LATTICE VIBRATIONS. E.W.Montroll and R.B.Potts.
Phys. Rev., Vol. 100, No. 2, 525-43 (Oct. 15, 1955).

The theory of the effect of localized defects such as impurities, holes and interstitials on the vibrations of crystal lattices is developed. Although most of the analysis is concerned with one-dimensional chains, the general approach to defects in three-dimensional lattices is outlined through the example of a simple cubic lattice with nearest-neighbour interactions. Many types of defects cause localized normal modes whose effect dies out rapidly with distance from the defect. Mathematical techniques, which involve the use of Green's functions, are discussed for the theory of these localized modes. The vibrational frequencies of these modes are displaced out of the band of frequencies of a perfect lattice. The theory of interaction of two defects as a function of their distance of separation is developed for the range of very low temperatures through the calculation of the change of zero point energy of a lattice as a result of the introduction of a defect pair. Defects attract each other in a monatomic lattice. The attraction between two mass defects in a linear chain is inversely proportional to the cube of their distance separation. The effect of a localized defect mode in a simple cubic lattice diminishes with the distance r as $r^{-1} \exp(-Ar)$. A.

548.7

793. CRYSTALLOGRAPHIC AND METALLOGRAPHIC PROOFS OF THE EXISTENCE OF IMPERFECTIONS IN METALLIC CRYSTALS. P.Lacombe.
J. Phys. Radium, Vol. 16, No. 7, 33 S - 34 S (July, 1955). In French.

The X-ray and microscopical evidence for the alignment of dislocations into sub-boundaries separating nearly perfect subcrystals is outlined very briefly. The importance of chemical impurity effects in showing dislocations by etching is mentioned. W.M.Lomer

548.7

794. ORDER OF THE HOLES IN PYRRHOTINE. E.F.Bertaut.
J. Phys. Radium, Vol. 16, No. 7, 42 S (July, 1955). In French.

The energy of the structure is considerably higher if the holes are disordered than if they are ordered. It is concluded that the holes must be ordered in all the non-stoichiometric structures from FeS to Fe_7S_8 (pyrrhotine). A.R.Stokes

548.7

795. IMPURITY DIFFUSION IN POLAR CRYSTALS. J.Teltow.
Phil. Mag., Vol. 46, 1026-8 (Sept., 1955).

It is shown how the author's earlier analysis (Z. phys. Chem. (Leipzig), Vol. 197, 145, 1951) should be corrected to agree with that of Lidiard (Abstr. 9236/1955). That term in the original paper which referred to diffusion of impurity atoms when not associated with vacancies can be significant only if an interstitial mechanism is concurrent with the vacancy one, as may be the case for Cu^+ in AgBr. W.M.Lomer

548.7

796. X-RAY SCATTERING EFFECTS DUE TO LOCALIZED STATIC LATTICE DEFECTS. C.W.Tucker, Jr and P.Senio.

Phys. Rev., Vol. 99, No. 6, 1777-81 (Sept. 15, 1955).

Theoretical calculations by Huang show that elastic singularities in a crystalline lattice should produce four specific X-ray scattering effects which include diffuse scattering and an artificial temperature factor. All four of the effects are present in neutron-irradiated crystals of boron carbide, diamond, silicon carbide, and magnesium oxide. Thus the model and calculations of Huang are qualitatively confirmed. It is suggested that it may be possible to determine more precisely the nature of the lattice distortions around localized static lattice defects from a detailed study of the diffuse scattering. A.

548.7 : 539.67

797. EXPERIMENTAL EVIDENCE FOR DISLOCATIONS IN CRYSTALLINE QUARTZ. H.E.Bömmel, W.P.Mason and A.W.Warner, Jr.
Phys. Rev., Vol. 99, No. 6, 1894-5 (Sept. 15, 1955).

Experimental measurements on AT vibrating quartz crystals have shown evidence of a relaxation. To verify this, measurements are described of the internal friction of single crystals from 1.5 to 300°K in the 5 to 80 Mc/s region. These show that two relaxation frequency—T curves are obtained, the lower activation energy curve being attributed to dislocations. The relaxation peak is similar to that in metals but there are fewer dislocations in quartz, which probably accounts for its smaller dissipation and greater mechanical stability. H.J.H.Starks

548.7

798. ON THE SPECTRAL LINE SERIES FOR EXCITON FORMATION IN Cu_2O. S.Nikitine, L.Couture, M.Sieskind and G.Perny.
J. Phys. Radium, Vol. 16, No. 7, 41 S - 42 S (July, 1955). In French.

548.7

799. ON COLOUR-CENTRE FORMATION. K.Grjotheim and J.Krogh-Moe.
Naturwissenschaften, Vol. 42, No. 17, 482 (1955). In German.

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.733

800. A SYSTEM FOR THE ELIMINATION OF ABSORPTIONAL ERRORS IN X-RAY INVESTIGATION WITH DEBYE–SCHERRER CYLINDRICAL CAMERAS. V.Scattùrin, M.Tornati and R.Zannetti.
Ricerca sci., Vol. 25, No. 6, 1447-60 (June, 1955). In Italian.

Diluting known powders with starch, so as to keep constant the product μr (where μ = linear coefficient of absorption, r = radius of cylindrical specimen) the fractional error in the interplanar distances is only dependent on the experimentally measured angle θ. From the powder diagrams of these known substances it is possible to obtain correction factors R = sin θ (theoretical)/ sin θ (experimental) also valid for any other type of substance diluted to the same product μr. As known powders the cubic substances NaCl, KCl, $Pb(NO_3)_2$, TlCl and Tl_2O_3 were used, which cover a range of μ from 161 cm^{-1} to 2120 cm^{-1}. They were diluted with starch to $\mu r = 2.5$ in order to obtain optimum diffractions. By the usual methods of extrapolation, the most probable lattice parameters "a_0" of these substances have been found. From those and from the lattice parameters "a" obtained from each line, the correction coefficients $R = a/a_0 = \sin\theta$ (theor)/ sin θ (exp) for θ values from 10° to 90° were computed. The coefficients R vary linearly with the function

$$f(\theta) = \tfrac{1}{2}\{(\cos^2\theta/\sin\theta) + (\cos^2\theta/\theta)\},$$

which confirms the validity of this function in the methods of extrapolation. They permit the corrected values of sin θ to be obtained for any type of powder diagrams on the condition that the specimens are diluted so as to have the same absorption. The precision of the corrected values of sin θ is discussed in view of their use in the analytical methods of indexing and in the identification by X-rays of crystalline substances. A.

548.733

801. METHOD OF OBTAINING X-RAY ROTATION PHOTOGRAPHS ABOUT THREE ORTHOGONAL AXES FROM ONE CRYSTAL MOUNTING. H.J.Grenville-Wells.
Acta cryst., Vol. 8, Pt 8, 519 (Aug., 1955).

The crystal is held on a glass fibre which makes the same angle with all three axes, so that any axis can be brought into the vertical by rotating the fibre. The device is similar to that described in Abstr. 1354 (1955). A. R. Stokes

548.733

802. THE EFFECT OF THE FILTER ABSORPTION EDGE IN X-RAY INTEGRATED INTENSITY MEASUREMENTS. R. F. Braybrook.
J. sci. Instrum., Vol. 32, No. 9, 365-6 (Sept., 1955)

Attention is drawn to a possible error in the wide-slit technique (Abstr. 5207/1953) due to a change in background intensity near a diffraction line. A. R. Stokes

548.734

803. ON THE QUESTION OF FINE-STRUCTURE INVESTIGATION BY X-RAYS THROUGH FLUORESCENCE MEASUREMENTS. L.Herforth.
Naturwissenschaften, Vol. 42, No. 14, 412 (1955). In German.

The use of a fluorescent screen and a photomultiplier tube for recording Debye–Scherrer patterns is considered. It is shown that in a typical case the current obtained would vary between 10^{-9} amp and 10^{-5} amp approximately. A.R.Stokes

548.734

804. CORRECTIONS APPLIED TO THE FOCUSING CAMERA WITH FLAT SPECIMEN. J. M. Codina and J. M. Serra.
An. Real Soc. Españ. Fís. Quím., Vol. 51 (A), No. 7-8, 185-8 (July-Aug., 1955). In Spanish.

See Abstr. 2875 (1954). The line displacement and the shape of the line profile are worked out for the case in which the specimen lies slightly off the focusing circle of the camera. A. R. Stokes

548.734

805. TWO CHARTS FOR SETTING THE BUERGER PRECESSION CAMERA. M. V. King.
Acta cryst., Vol. 8, Pt 1, 56 (Jan., 1955).

548.734

806. PRECESSION CAMERA SETTINGS. D. J. Fisher.
Acta cryst., Vol. 8, Pt 9, 594 (Sept., 1955).

Some comments are made on King's paper (preceding abstract). The author considers his own methods (American Mineralogist, Vol. 37, 1036, 1952; Vol. 38, 399, 1953) to be simpler in application. A. R. Stokes

548.734

807. PRECISION DETERMINATION OF LATTICE CONSTANTS WITH A GEIGER-COUNTER X-RAY DIFFRACTOMETER. A.Smakula and J.Kalnajs.
Phys. Rev., Vol. 99, No. 6, 1737-43 (Sept. 15, 1955).

It is shown that the Geiger-counter X-ray diffractometer can be used for precision determination of lattice constants. The zero point of the goniometer (determined by two methods) and the position of the diffraction lines (2θ) were obtained with an accuracy of $\pm 0.001°$. The temperature was kept con-

stant by a special unit within 0.05 deg C. An investigation of the systematic errors was made, which shows that the extrapolation of lattice constants v. $\cos^2\theta$, according to Wilson's equation, is permissible and the vertical divergence error, as computed by Eastabrook, lies within the tolerances for 2θ up to 165° and may be neglected. The lattice constants of Al, Ag, Ge, Si, CaF_2, CsI, TlCl and TlBr, determined by extrapolation, are in good agreement with published data. The limiting factor in the accuracy of the lattice constant determination is not in the error of the diffractometer, but in the X-ray wavelength. A.

548.734.3

808. PREFERRED ORIENTATION OF PLATELETS IN X-RAY DIFFRACTOMETER POWDER SAMPLES.
J. E. Manson.
J. appl. Phys., Vol. 26, No. 10, 1254-7 (Oct., 1955).

A method is described for elimination of the effects of preferred orientation of platelets in a compressed powder sample having a plane surface exposed to the X-ray beam. The powder is diluted with a low absorption amorphous resin and the results extrapolated to zero concentration. The extrapolation is justified by analysis of an idealized model of the sample. A comparison between the analytical results and the results of an experimental study using silver iodide indicates the validity of the process. A.

548.734.5

809. A RETIGRAPH (DIRECT PROJECTION X-RAY GONIOMETER). V. A. Vuster (Wooster).
Acta tech. Hungar., Vol. 12, No. 1-2, 165-76 (1955). In Russian.

548.734.8

810. PHOTOGRAPHIC INTENSITY SCALES FOR USE WITH THREE-DIMENSIONAL DATA. H. J. Grenville-Wells.
Acta cryst., Vol. 8, Pt 8, 512-13 (Aug., 1955).

Describes a method of calibrating films for intensity measurements which overcomes the difficulties due to oblique incidence, namely variation, with obliquity, of spot size and shape and of absorption correction in film packs. This is done by making a separate calibration for each layer-line. A. R. Stokes

548.735

811. THE QUANTITATIVE EVALUATION OF PHOTOGRAPHIC X-RAY DIFFRACTION PATTERNS BY MEANS OF A CONVERTER. J.C.M.Brentano.
Royal Photographic Society International Conference (London), 215. See Abstr. 7586 (1955).

Describes briefly the principle of an electronic converter which turns transparency readings from a photoelectric cell into X-ray-exposure readings. The converter is calibrated by standardization against two known exposure values, and 2 per cent accuracy is claimed. A.R.Stokes

548.735

812. THE REFRACTION CORRECTION FOR LATTICE CONSTANTS CALCULATED FROM POWDER OR ROTATION CRYSTAL PATTERNS. M.E.Straumanis.
Acta cryst., Vol. 8, Pt 10, 654-6 (Oct., 1955).

Although Barrett ("Structure of metals" p. 150; New York, 1952) considers that the refraction correction should not be applied, the author gives theoretical and experimental evidence for the need to apply it in all highly accurate work on lattice constants. A.R.Stokes

548.735

813. METHODS FOR THE CORRECTION OF X-RAY INTENSITIES FOR PRIMARY AND SECONDARY EXTINCTION IN CRYSTAL STRUCTURE ANALYSIS. V.Vand.
J. appl. Phys., Vol. 26, No. 10, 1191-5 (Oct., 1955).

The theory of X-ray extinction in diffraction studies is reviewed, and application to small crystals completely bathed in the incident beam is considered. Using a suitable approximation to a sum of Bessel functions, a correction formula is obtained, valid in the region of small Bragg angle where the extinction is likely to be greatest. The formula is discussed; and it is shown that when the crystal structure is essentially known, as in later stages of refinement, it is possible to separate the effects of primary from secondary extinction and to correct the experimental data accordingly. A.

548.735.4

814. SYMMETRY RELATIONS BETWEEN STRUCTURE FACTORS. J.Waser.
Acta cryst., Vol. 8, Pt 9, 595 (Sept., 1955).

A general relation is derived between a space-group operation and the corresponding structure-factor equality, and an example is worked out in detail. A. R. Stokes

548.735.44/.46

815. OBLIQUE PROJECTIONS. P. J. Black.
Acta cryst., Vol. 8, Pt 10, 656-7 (Oct., 1955).

Describes some useful properties of Fourier or Patterson projections along directions other than crystal-axis directions, when taken in conjunction with a projection along an axis. A. R. Stokes

548.735.44

816. A METHOD FOR STRUCTURE DETERMINATION IN SIMPLE CENTROSYMMETRICAL SYSTEMS. A. Björnhaug and J. Krogh-Moe.
Acta cryst., Vol. 8, Pt 7, 441 (July, 1955).

Discusses the use of a modified Fourier synthesis in which both the structure amplitudes and the cosine terms are given their absolute (modulus) values. Trials showed that atomic positions could be picked out easily in the case of simple structures, but not in more complex structures, e.g. oxalic acid dihydrate. A. R. Stokes

548.735.44

817. AN ANALYTICAL METHOD OF DEALING WITH UNRESOLVED PEAKS IN FOURIER PROJECTIONS. D. M. Burns.
Acta cryst., Vol. 8, Pt 8, 517-18 (Aug., 1955).

An expression is obtained for the distance between centres of unresolved peaks in terms of the eccentricity of elliptical contours of electron density, assuming a Gaussian distribution of density in each peak. A. R. Stokes

548.736.1

818. LATTICE CONSTANTS OF GRAPHITE AT LOW TEMPERATURES. Y.Baskin and L.Meyer.
Phys. Rev., Vol. 100, No. 2, 544 (Oct. 15, 1955).

The lattice constants of a graphite single crystal, natural graphite powder, and artificial graphite powder have been measured at 297° K, 78° K and 4.2° K. The a-spacing does not change in this temperature range within the error of ±0.0005 A. The material with the greatest c-spacing showed between 297° and 78° the greatest change of c-spacing and the smallest change below 78°. The c-spacing of the artificial powder did not return to its original value at 297° after a thermal cycle, demonstrating irreversible deformation. A.

548.736.2

819. X-RAY LATTICE CONSTANT OF BARIUM OXIDE. R.J.Zollweg.
Phys. Rev., Vol. 100, No. 2, 671-3 (Oct. 15, 1955).

Precision measurements of the X-ray lattice constant of pure BaO were made at temperatures between 8° K and 435° K with a back-reflection symmetrical-focusing camera. Room temperature measurements of coloured BaO indicate a contraction of the lattice associated with the presence of excess barium. A.

548.74

820. INTENSITY MEASUREMENT IN ELECTRON DIFFRACTION BY MEANS OF A CdS SINGLE CRYSTAL. S. Takagi and T. Suzuki.
Acta cryst., Vol. 8, Pt 7, 441-3 (July, 1955).

A CdS crystal is used instead of a photographic plate for the detection and measurement of diffracted beams of electrons, a current of the order of 10^{-7} to 10^{-4} A being obtained in a crystal with an effective irradiated area of 0.3 mm x 1.0 mm. In spite of hysteresis effects, which still remain to be overcome, the method is already useful for the detection of weak haloes, the measurement of the widths of diffraction rings, rough estimates of intensity etc. J. Thewlis

548.74

821. NOTE ON ELECTRON DIFFRACTION PATTERNS OF CuO. R.D.Heidenreich and K.H.Storks.
J. appl. Phys., Vol. 26, No. 8, 1056 (Aug., 1955).

Concludes, from electron diffraction and electron microscope observations, that the intensity anomalies in electron diffraction patterns of CuO do not arise from crystal shape, but result either from the structure itself or from the interaction of diffracted beams within the crystal. J.Thewlis

548.74 : 539.185

822. NEUTRON DIFFRACTION. G.E.Bacon.
Oxford: Clarendon Press; London: Oxford University Press (1955) ix + 299 pp. (Monographs on the Physics and Chemistry of Materials).

Review in Nature (London), Vol. 176, 895-6 (Nov. 12, 1955).

GEOPHYSICS 55

ATMOSPHERE. METEOROLOGY 551.5

551.510.535

823. INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS. MIXED COMMISSION ON THE IONOSPHERE. PROCEEDINGS OF THE FOURTH MEETING, BRUSSELS, AUGUST 16-18, 1954.
Secrétariat Général de l'U.R.S.I., 42 Rue des Minimes, Brussels (1955) 238 pp.

Abstracts of some of the papers will be published in later issues.

551.510.535

824. ON THE SOLAR LYMAN BETA RADIATION AND THE IONOSPHERE. S.Kato.
J. Geomagn. Geoelect., Vol. 6, No. 3, 153-6 (Sept., 1954).

Since the Lyβ line of hydrogen coincides in wavelength with the radiation corresponding to the $^3P-^3D$ transition in atomic oxygen, it may be expected that in the ionosphere $O(^3D)$ atoms will be produced by absorption of the solar Lyβ radiation. The possible processes resulting from the presence of these atoms are considered, and that in which the incident Lyβ line is split into two scattered radiations is examined in detail. G.M.Brown

551.510.535

825. USE OF ROCKETS FOR THE STUDY OF THE IONOSPHERE. J.C.Seddon and J.E.Jackson.
Ann. Géophys., Vol. 11, No. 2, 169-72 (April-June, 1955). In French.

Radio waves from a transmitter on the rocket are received by an observer at the ground. By noting the change of frequency the speed and trajectory of the rocket are obtained. With an improved method and continuous registration the attenuation of the ordinary and extraordinary rays are obtained. The Appleton–Hartree formula is used to calculate the electronic distribution and certain additional ionospheric quantities. From the electronic density and the height at which the extraordinary ray disappears one verifies that the earth's magnetic field decreases inversely with the cube of the distance from the earth's centre, and the number of electronic collisions at that height is found. The electronic density is very feeble at 90 km but increases rapidly from 90 to 105 km and then decreases a little. This conflicts with Chapman's theoretical prediction, probably because the coefficient of recombination is not constant. Doubts also exist regarding the height of the F2 layer. The authors take a very critical attitude regarding the calculations deduced from the height scale of semi-thickness of the regions E and F2 since they accept implicitly the existence of so-called parabolic layers created by monochromatic radiation. R.S.Read

551.510.535

826. A NEW REPRESENTATION OF THE LONGITUDE EFFECT IN THE IONOSPHERIC F2 LAYER. F.Delobeau.
C.R. Acad. Sci. (Paris), Vol. 241, No. 4, 439-41 (July 25, 1955). In French.

A graph of magnetic dip plotted against geographic latitude, allowing for magnetic distortion, gives a series of displaced similar curves depending on the longitude reckoned from the meridian which contains the magnetic poles. The positions of the actual ionospheric stations in service are also shown, and these lead to interesting conclusions. The meridian which would give a curve nearest to that expected if the earth's rotary and magnetic axes coincided passes through the great oceans and contains very few stations. G.M.Brown

551.510.535

827. THE LUNAR SEMI-DIURNAL OSCILLATION IN THE IONOSPHERIC ABSORPTION OF 150 kc/s RADIO WAVES. A.P.Mitra.
J. atmos. terrest. Phys., Vol. 7, No. 1-2, 99-100 (Aug., 1955).

Separate harmonic analysis of daytime results, believed to refer to D-region absorption, and night-time results (E-region absorption) indicate the respective lunar semi-diurnal oscillations $0.05 \sin(2t' + 160^0)$ and $0.03 \sin(2t' + 260^0)$ neper. Interpretation in terms of bodily movement of ionization can only be valid for D-region heights. G.M.Brown

551.510.535

828. RECOMBINATION AND ION PRODUCTION FROM THE TOTAL ELECTRON CONTENT. N.J.Skinner and R.W.Wright.
J. atmos. terrest. Phys., Vol. 7, No. 1-2, 105-7 (Aug., 1955).

Corrections are given to previous (Abstr. 1389/1955) expressions for the mean coefficient of recombination $\bar{\alpha}$ and mean rate of ion production $\bar{q}$ throughout the F-layer as obtained from the diurnal variation of the total electron content of a column of unit cross-section below the layer maximum. Values of $\bar{\alpha}$ and $\bar{q}$ for Ibadan for 1952 show strong maxima at 0800 and 1600 hr on magnetically quiet days; these are much reduced on disturbed days. Interpretation in terms of vertical ion drift is suggested. G.M. Brown

551.510.535

829. ON AN ECHO TRACE OF UNUSUAL CHARACTER OBSERVED ON IONOGRAMS FOR THE STATION IN THE KERGUELEN ISLANDS. R.Busch and A.Luchet.
C.R. Acad. Sci. (Paris), Vol. 241, No. 5, 507-9 (Aug. 1,

1955) In French.

Examples are given of echo patterns arising from virtual heights of 48-55 km in summer and 55-65 km in winter. Reflections appear uninfluenced by the upper layers, persisting even when there is strong absorption. The linear traces do not signify the existence of a critical frequency. G.M.Brown

551.510.535

830. ON LATITUDINAL DISTRIBUTIONS OF DIURNAL AND SEMI-DIURNAL COMPONENTS OF h'F2 OF THE IONOSPHERE. T.Sato and T.Namikawa.

J. Geomagn. Geoelect., Vol. 6, No. 3, 157-9 (Sept., 1954).

Graphs are given showing the distribution in latitude (geographic and geomagnetic) of the phase and amplitude of both the diurnal and semi-diurnal components of h'F2 for the months Dec. 1945 and June 1946. Brief conclusions are given. G.M.Brown

551.510.535

831. VARIATION OF fEs DURING SOLAR ECLIPSES. W.Stoffregen.

Nature (London), Vol. 176, 610 (Sept. 24, 1955).

It appears that no eclipse variations of fEs are found at places where the obscuration is less than about 75%, but where it is total or nearly total fEs decreases simultaneously with the course of the eclipse, preceded by an increase some hours before the moon's shadow strikes the earth. G.M.Brown

551.510.535

832. RADIO OBSERVATIONS OF THE IONOSPHERE AT OBLIQUE INCIDENCE. J.H.Chapman, K.Davies and C.A.Littlewood.

Canad. J. Phys., Vol. 33, No. 12, 737-22 (Dec., 1955).

A description is given of an automatic method of using the radio pulse technique at oblique incidence to investigate the structure of the ionosphere. Sweep frequency photographic records were taken for the path Ottawa–Saskatoon (2355 km). The records obtained confirm the validity of the theory relating vertical incidence to oblique incidence propagation. Sweeps showing such phenomena as E layer cutoff, transmission of the Pedersen ray, multiple reflections, are shown. It is found that the F1 layer is the important propagating layer rather than the F2 layer under certain conditions. Hence conventional methods of predicting frequencies over long distances require modification in these circumstances. A.

551.510.535 : 621.396.11

833. THE TECHNIQUE OF IONOSPHERIC INVESTIGATION USING GROUND BACK-SCATTER. E.D.R.Shearman.

Proc. Instn Elect. Engrs, Paper No. 1915 R, publ. Oct., 1955, 14 pp. To be republished in Vol. 103 B (1956).

The skip distance in short-wave propagation is measured by observing the time delay of echoes scattered from the earth's surface beyond the skip distance. A theoretical study shows that the method should give good accuracy in determining skip distance, but cannot yield unique values of the height and critical frequency of an ionospheric layer at a distant point. The radar equation is used to find the intensity of back-scatter from the ground, and an approximate calculation indicates that the irregularities present on land and sea should be sufficient to explain the observed echo strength. The effect of ray focusing by the ionosphere is considered. Experimental results confirm earlier conclusions that the predominant sources of echoes are on the ground and not in the E-region. An empirical correction for the effect of the earth's magnetic field shows that no error in the location of the sources is introduced by using no-field theory in the analysis of results. A.

551.510.535 : 621.396.11

834. SOME REMARKS ON SCATTERING FROM EDDIES. R.A.Silverman.

Proc. Inst. Radio Engrs, Vol. 43, No. 10, 1253-4 (Oct., 1955).

The Gaussian character of electromagnetic radiation scattered from turbulent atmosphere fluctuations is shown to follow from the Central Limit Theorem, even when the scattering is from only one macro-eddy and there is coupling between eddy motions of different sizes. It is suggested that including the effects of eddy coupling may increase the calculated average scattered power enough to give agreement with experiment. A.

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.521.3 : 535.43

THE DIFFUSION OF LIGHT THROUGH A SCATTERING LAYER OF GREAT OPTICAL THICKNESS. See Abstr. 272.

551.521.326

835. A NEW PROCEDURE FOR THE PHOTOMETRIC STUDY OF MONOCHROMATIC EMISSIONS FROM THE NIGHT SKY. J. É. Blamont and G. Courtés.

Ann. Géophys., Vol. 11, No. 2, 252-4 (1955). In French.

The new method permits of a detailed interferential study of the entire sky by means of photographic photometry. By combining the essential features of an optical system to image the whole sky on to a photographic plate, and a Fabry–Perot or Savart–Lyot interferometer, the following photometric conditions are satisfied: (i) The exposure time does not exceed that required to complete a photoelectric scan of the whole sky; (ii) no distortion of the photometric results is introduced by the integrated sky background; (iii) all the required information is obtained from a single exposure on one plate. Microphotometry of the fringe-pattern super-imposed on the sky image, as photographed, enables relative intensities of monochromatic emission in different regions of the sky to be derived. D. R. Barber

551.521.326 : 535.247.4

NIGHT-SKY PHOTOMETRY. See Abstr. 181-2.

551.521.326 : 535.3

836. ANALYSIS OF THE NIGHT-SKY SPECTRUM. D. Barbier.

Ann. Géophys., Vol. 11, No. 2, 181-208 (1955). In French.

A detailed survey of observational results to date. These indicate that, with the exception of atmospheric sodium, the only elements observed in emission are those present in the lower atmosphere, or their dissociation products. All the observed transitions, with the two exceptions of the D lines of sodium, and the bands of OH, are forbidden. For the molecular band-systems observed in emission, the population of the vibrational levels is found to be abnormal. A valuable bibliography of 74 items is appended. D. R. Barber

551.521.326 : 535.3

837. CONTRIBUTION TO THE STUDY OF THE NIGHT-SKY SPECTRUM IN THE VIOLET AND NEAR ULTRAVIOLET. M. Dufay and J. Dufay.

Ann. Géophys., Vol. 11, No. 2, 209-13 (1955). In French.

Complementary to preceding abstract. Detailed descriptions are given of the night-airglow spectrum between 3400 A and 4000 A, dispersions ranging from 160 A/mm to 300 A/mm. A number of relatively weak emissions remain unidentified of which the line at 4018.6 A is the strongest. D. R. Barber

551.591

838. VISIBILITY OF LIGHT SOURCES IN FOG: APPLICATION TO THE PROBLEM OF LANDING UNDER BAD WEATHER CONDITIONS. J.Olivier.

Bull. Soc. Franc. Elect. (Ser. 7), Vol. 5, 538-52 (Aug., 1955)

n French.

A comprehensive paper on matters affecting the visibility of lights to a pilot making a landing in fog or haze. The first part deals with the actual process of coming in to land and the way in which the pilot is helped; the second deals with the mechanism of seeing in fog and gives an account of relevant experimental work; the third is concerned with the constitution and properties of fog. It is here that most progress has been made recently and the author gives a critical account of this, emphasizing that in meteorology the term "visibility" is used both for a light seen at night and for an extended object seen by day, although the two phenomena are quite distinct. The final section contains a study of the relation between visibility in a horizontal direction and visibility when looking obliquely. It is concluded that visibility can be predicted from three measurements, viz. (a) the optical density in the horizontal direction, (b) the luminance of the horizon and (c) the mean vertical density. J.W.T.Walsh

551.593 : 550.385

839. CHANGES IN BRIGHTNESS, POLARIZATION, AND COLOUR OF THE ZENITH DAY SKY ACCOMPANYING GEOMAGNETIC ACTIVITY. D. R. Barber.
J. atmos. terrest. Phys., Vol. 7, No. 3, 170-2 (Sept., 1955).

Photoelectric measurements of zenith sky light at 4800 A and 6200 A on 50 cloudless days of varying magnetic character during 1949-50-51, when compared with those obtained on magnetically quiet days, reveal systematic changes in brightness, polarization and colour of the sunlit sky, which appear to be significantly related to the degree of geomagnetic activity (Abinger K index) at the hour of observation. Under very disturbed conditions, when K is greater than 6, the increase of sky-brightness in red light is about 50% of the mean value at K = 0, i.e. about five times that found by Abbot (1948) from sky-brightness measurements in the vicinity of the sun, following intense geomagnetic storms. D. R. Barber

551.594

840. APPARATUS AND METHODS OF MEASUREMENT FOR ATMOSPHERIC ELECTRICAL INVESTIGATIONS. II. MEASUREMENTS OF ELECTRIC FIELDS (POTENTIAL GRADIENTS) IN THE ATMOSPHERE. H. Israël.
Arch. tech. Messen, Issue No. 233, (Ref. V656-3), 125-8 (June, 1955). In German.

For Pt I, see Abstr. 919 (1954). Brief summary of the methods of measuring the "static" atmospheric field.
J. Dutton

551.594.14

841. OBSERVATIONS ON RADIOACTIVE VAPOUR FROM ATOMIC EXPERIMENTS IN THE YEARS 1953/54. A. Sittkus.
Naturwissenschaften, Vol. 42, No. 17, 478-82 (1955). In German.

Records data from rainfall at Freiburg, Germany, on the radioactivity of the atmosphere and describes a method of deducing the time of the explosion from the observations.
J.M.Hough

551.594.5

842. VERTICAL EXTENT OF AURORAL ARCS AND BANDS. B.W.Currie and J.T.Weaver.
Canad. J. Phys., Vol. 33, No. 11, 611-17 (Nov., 1955).

Measurements of the vertical extent of quiet arcs and bands from 181 auroral photographs, taken at Chesterfield (63.3° N., 90.7° W.), Coppermine (67.8° N., 115.2° W.), and Saskatoon (52.1° N., 106.6° W.), indicate that these forms are confined to a narrow layer of the atmosphere immediately above the 100 km level. The most frequent thickness of this layer is between 20 and 40 km. Values in excess of 50 km rarely occur. The percentage of auroral time that the luminosity is restricted to this layer is uncertain. The ratio of the number of arcs and bands to the total number of observed forms suggests a value exceeding 50%. When the occurrence of each form is weighted according to the angular field covered by it, a value as high as 60% is indicated. A.

551.594.51

844. AURORAL RAYS AS ELECTRIC-DISCHARGE PHENOMENA. J. W. Chamberlain.
Astrophys. J., Vol. 122, No. 2, 349-50 (Sept., 1955).

Consideration is given to the mode of formation of auroral rays, as distinct from arcs known to be associated with incident protons. To account for the nearly constant luminosity with height, and density observed for rays, it is suggested that these originate in an atmospheric discharge excited by inelastic collisions of atoms and molecules with incident electrons. Application of this theory leads to electron current-densities several orders of magnitude greater than those for protons; and also an electron-density higher than that normally present in the undisturbed ionosphere. D. R. Barber

551.594.5

843. AURORAL HEIGHTS OVER WEST-CENTRAL CANADA. B.W.Currie.
Canad. J. Phys., Vol. 33, No. 12, 773-9 (Dec., 1955).

A complete analysis of the parallactic photographs of aurora taken at Chesterfield, N.W.T., (63.3° N, 90.7° W) in 1933 show (a) a marked maximum in the heights of the lower limits of both homogeneous arcs and bands and auroral structures with rays between 100 and 110 km, (b) a mean height of the lower limit of arcs and bands of 108.2 km, (c) a mean height of the lower limit of auroral structures with rays of 113.4 km, (d) a decrease of height with increasing intensity, and (e) no definite evidence of a change of height with time after sunset. The results suggest that heights of aurora as observed from Northern Canada are slightly higher than of aurora observed from Norway.. This may be due to the locations of the two regions relative to the zone of maximum auroral occurrence. No exceptionally low heights were observed at Chesterfield. Remeasurements of the 1933 photographs for Saskatoon (52.1° N, 106.6° W.) indicate that one arc was definitely below the 70-km level, and possibly below the 60-km level. A.

551.594.51 : 535.33

845. IS HELIUM A COMPONENT OF AURORAL PARTICLES? C. Y. Fan.
Astrophys. J., Vol. 122, No. 2, 350-1 (Sept., 1955).

It is shown that the absence of Doppler-shifted He lines in early lab. emission spectra of air at pressures $\geq 10^{-1}$ mm Hg bombarded by high-energy He^+ ions may be explained by collisional de-excitation. Since, under these conditions, the mean life of the first bound electron of an He atom is only 10^{-9} sec, an excited atom will have lost its electron before the optical transition can occur. Recent spectra at pressures of about 10^{-4} mm Hg clearly show the displaced He lines. A search for the 5876 A He line in the auroral spectrum is desirable, since this should be detectable if 5% or more He^+ ions are present in the stream of incident auroral particles.

BIOLOGY 57/59

591.1.044

846. MECHANICAL MECHANISM OF DESTRUCTIVE EFFECTS OF SOUND ON TISSUE. W.Welkowitz.
J.Acoust. Soc. Amer., Vol. 27, No. 6, 1142-4 (Nov., 1955).

A mechanical mechanism is presented to explain some of the nonthermal, noncavitation effects of high-intensity sound on tissue. The theory proposes that the observed effects result from unidirectional forces produced by the acoustic wave, and that these forces cause elastic failure in the system. Some experimental verification is presented from measurements on irradiated frog muscle tissue and on irradiated frog spinal cord. A.

591.1.044

847. EFFECTS OF NOISE ON THE BLOOD EOSINOPHIL LEVELS AND ADRENALS OF MICE. A.Anthony and E.Ackerman.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1144-9 (Nov., 1955).

Physiological changes are described following exposure of mice to single and intermittent noise stimulation (110 db re 0.0002 dyne/cm^2, 10-20 kc/s) for varying lengths of time. Attention is focused on the degree of adreno-cortical activation as measured by cytological changes in the adrenal gland and fall in the number of circulating eosinophils. Since the observed changes were transient, of short duration and no evidence of systemic pathology could be detected, the noise was described as not harmful. The tendency of certain investigators to regard noise as an injurious, nonspecific stress stimulus without specifying the exact nature of the noise situation does not seem justified. A.

591.1.044

848. EFFECTS OF NOISE ON EOSINOPHIL LEVELS OF AUDIOGENIC-SEIZURE-SUSCEPTIBLE AND SEIZURE-RESISTANT MICE. A.Anthony.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1150-3 (Nov., 1955).

The occurrence of a diurnal rhythm in circulating eosinophils is described in mice selected on the basis of susceptibility to sound-induced audiogenic seizures. Daily exposures of seizure-susceptible and seizure-resistant mice to single, short noise bursts for 30 days does not abolish or alter this rhythm, provided a recovery period is allowed between the last stimulation and the time of blood sampling. A single noise stimulus is followed by a moderate eosinopenia in seizure-resistant mice and a marked eosinopenia in seizure-susceptible mice in about 3 hours; recovery occurs in both cases within 24 hours. A prolonged eosinopenia occurs with several successive noise bursts — at a moderately low level (about 250 eosinophils/mm^3 blood) in seizure-resistant mice and at lower levels (about 100 eosinophils/mm^3 blood) in mice which experience convulsions during treatment. It was concluded that noise stimulation acts as a mild stress stimulus and is harmful only when it results in the production of fatal convulsions. A.

MEDICAL SCIENCE. HUMAN PHYSIOLOGY 61

612.843.31

849. THE DIFFERENTIAL SENSITIVITY OF THE EYE TO COLOURS IN THE NEWTONIAN SCALE PARTICULARLY FOR THE SENSITIVE COLOURS. E.Ingelstam and L.Johansson.
Optica Acta, Vol.2, No. 3, 139-43 (Oct., 1955). In French.

An experimental determination was made of the eye's ability to discriminate interference colours along the Newtonian scale within and on both sides of the first order sensitive colour. The application aimed at is to measure optical path gradients by means of the double quartz plate as suggested by Francon and accordingly the field of view consists of a fairly narrow band. The mean deviation of the settings was found to correspond to about 8 A in the most sensitive region. Any gradient or path difference value can be measured with the corresponding accuracy of 20 A by means of a compensator acting as zero method at the sensitive colour. Coefficients of self-diffusion of very dilute solutions can be measured as accurately as those of higher concentration with ordinary methods. A.

612.843.31 : 535.65

850. CHROMATICITY DIFFERENCE THRESHOLDS IN THE DIRECTION OF THE BLUE PRIMARY OF A SYSTEM OF TRICHROMATIC SYNTHESIS. P.Billard.
Rev. Opt., Vol. 34, No. 7-8, 371-405 (July-Aug., 1955). In French.

Measurements of colour difference threshold have been made with an instrument described in the paper. The results are given in some detail. With a $2\frac{1}{2}^0$ field and a luminance of 30 cd/m^2 the threshold is about 5 times MacAdam's standard deviation when the colour is white or yellow and the background dark. As the colour is moved towards the blue the threshold decreases. It is greater for small fields (6 to 10 times for a field of 0.3°) and for lower luminances (4 times for 1 cd/m^2). The effect of a bright surround has been studied. Certain conclusions are drawn as regards the permissible degradation of colours in a picture produced by trichromatic synthesis. J.W.T.Walsh

612.843.32

851. AMPLITUDE OF RESPONSE AND RELATIVE SPECTRAL SENSITIVITY OF THE HUMAN ELECTRORETINOGRAM. J.C.Armington.
J. Opt. Soc. Amer., Vol. 45, No. 12, 1058-64 (Dec., 1955).

Deals with the conditions which modify spectral sensitivity of the photopic retinal action potential (ERG). The parameter of visual angle (retinal area) and level of response have received particular attention. It was found that when responses are small, their relative spectral sensitivity is nearly independent of stimulus diameter. More sizeable responses have a greater relative sensitivity to red light. With conditions of large stimulus area, electro-retinal sensitivity shows a close agreement with existing psychophysical determinations of luminosity. The results are considered in relation to earlier studies of the ERG and the stray light hypothesis. A.

612.843.3

852. INFRARED SKIASCOPIC MEASUREMENTS OF REFRACTIVE CHANGES IN DIM ILLUMINATION AND IN DARKNESS. N.B.Chin and R.E.Horn.
J. Opt. Soc. Amer., Vol. 46, No. 1, 60-6 (Jan., 1956).

A brief review of the literature on night myopia and empt field myopia and the disagreement over their causes is presented. Measurements of the refractive state of the eye in reduced illumination and in darkness were made using an infr red skiascope. For about half of the subjects, there was an increase in the refractive state of the eye as the illumination was lowered. The contribution of accommodation to the night myopia measured, was generally small. Under conditions of complete darkness, all of the subjects showed variable spasm of accommodation. A

612.843.61

853. PERIPHERAL AND FOVEAL DARK-ADAPTATION CURVES AS A FUNCTION OF LUMINANCE AND WAVE-LENGTH. J.J.Mertens.
Optica Acta, Vol. 2, No. 3, 134-9 (Oct., 1955).

Peripheral and foveal dark-adaptation curves were meas

ed after stimulation by luminances ranging from 1300 to 7 cd/m^2 for red, yellow, green and violet light-adaptation eld and test spot. It was found that the dark-adaptation time the cone apparatus depends but slightly on the colour of the imulating field and the test spot. The dark-adaptation time the rod apparatus appeared to be strongly dependent on the olour of the stimulating field. Typical peripheral adaptation irves are shown and some typical phenomena in foveal adaption are mentioned. A.

612.843.611

54. STUDIES ON DARK ADAPTATION. I. THE PRE-XPOSURE TOLERANCE OF THE DARK-ADAPTED FOVEA. .E.Johannsen, P.I.McBride and J.W.Wulfeck.
Opt. Soc. Amer., Vol. 46, No. 1, 67-71 (Jan., 1956).

The effect on foveal dark adaptation of pre-exposure of the re for brief durations to light of relatively low brightness was vestigated. Monocular measurements of absolute brightness ensitivity (RL) were made with a modified Crozier-Holway scriminometer. A one degree square, centrally fixated test itch was presented for 0.033 sec. The course of dark adaption as measured by the RL was investigated following pre-xposures of the dark-adapted eye to 0.10, 1.0, 10 and 100 ft-L r 1, 10 and 100 seconds. Dark adaptation was too slight to e measured by the techniques used in this investigation following pre-exposures of the dark-adapted eye to quantities of ght in which the brightness x duration product was 100 foot-mbert-seconds or less. The extent of dark adaptation was und to increase as combinations of pre-exposure duration and rightness increased above that critical value. A.

612.843.7

55. THRESHOLD OF PERCEPTION BY THE EYE OF A UMBER OF OBJECTS IN THE FIELD OF VIEW. P.Jainski.
ichttechnik, Vol. 7, No. 10, 382-7 (Oct., 1955). In German.

Previous work on the threshold of perception has generally een done with a single object in the field of view. This work s summarized and the results compared with that part of the resent work which is relevant. The experiments described efer to various numbers of objects variously dispersed over ie visual field, and it is found that in such cases there is a ertain extent of dispersion which gives a minimum value for ie threshold. The results are shown graphically. Experiients have also been made on the threshold for rectangles of onstant area but different ratios of length to breadth. The reshold is a minimum from 1 : 1 to 2 : 0.5 but rises progressively for greater ratios. J.W.T.Walsh

612.843.721

56. ON BINOCULAR SUMMATION. M.Aguilar.
ptica Acta, Vol. 2, 105 (July, 1955). In French.

The effect of the level of adaptation A of the left eye on the differential sensitivity $\Delta L/L$ of the right one has been studied. $\Delta L/L$ is a minimum when A is approximately the same in both eyes. R.A.Weale

612.846

857. THE STABILISED RETINAL IMAGE. R.W.Ditchburn and D.H.Fender.
Optica Acta, Vol. 2, No. 3, 128-33 (Oct., 1955).

A beam of light reflected from a mirror attached to a contact lens, worn by the subject, produces a test object whose image does not move across the retina in response to eye-movements. This is called the stabilized retinal image. Conditions for accurate stabilization are discussed. It is shown that a small defect of stabilization is important and that normal vision may be restored by introducing small movements which simulate some of the normal movements of a retinal image. Experiments on the stabilized image with light interrupted at different frequencies are described and it is shown that normal vision is obtained near the flicker fusion frequency. A.

612.858.76

858. FURTHER STUDIES ON PERSTIMULATORY FATIGUE. J.P.Egan and E.J.Thwing.
J. Acoust. Soc. Amer., Vol. 27, No. 6, 1225-6 (Nov., 1955).

Perstimulatory fatigue, or auditory adaptation, was measured by various procedures which were designed to determine (1) the effects of brief re-stimulation of the adapted ear, and (2) the role of sound localization. A.

614.825

859. ELECTRIC DEFIBRILLATION. W.B.Kouwenhoven and W.R.Milnor.
Trans Amer. Inst. Elect.Engrs III, Vol. 74, 561-7 (1955) = Pwr Apparatus Syst., No. 19 (Aug., 1955).

Experiments on animals are described in which varying counter-shocks have been applied to hearts in a fibrillating condition to check the fibrillations and to induce normal beating. Three forms of shock include capacitor discharge, serial defibrillation by repeated small shocks and a.c. defibrillation by a single pulse of 60 c/s energy. The last proved most effective, using 8-12 A at 480 V with external electrodes on dogs, with a 1 sec. discharge. In all cases the counter-shock requires to be applied within approx. 1 min. of the initial shock: at 2 min., recovery is unlikely. In the discussion is described a special electrode harness arrangement kept in a h.v. laboratory for immediate use in conjunction with artificial respiration. E.H.W.Banner

TECHNIQUE. MATERIALS 62/69

666

860. COLOUR OF TELLURITE GLASSES. P.L.Baynton. Nature (London), Vol. 176, 691-2 (Oct. 8, 1955).

The slight yellow-green colour of tellurite glasses made from commercial materials is due to Fe impurities and can be greatly diminished by using a purer form of TeO_2.

R.O.Davies

666 : 539.217 : 533.5

OUTGASSING OF GLASS. See Abstr. 127.

669

861. ON ZONE REFINING. J.L.Birman.
J. appl. Phys., Vol. 26, No. 10, 1195-7 (Oct., 1955).

A matrix method is used to solve the difference equations which describe the zone refining of a bar. The matrix method is designed for direct numerical calculation of the solute distribution, after any number of passes, with any initial solute distribution. The method is illustrated with a simple example.

A.

PHOTOGRAPHY 77

771.534.

862. AN AUTOMATIC RECORDING MICRODENSITOMETER. V. A. Vuster (W. A. Wooster).
Acta tech. Hungar., Vol. 12, No. 1-2, 177-86 (1955). In Russian.

778 : 537.542

PHOTOGRAPHIC EFFECT OF COUNTER DISCHARGES. See Abstr. 426.

778.34

863. A STUDY OF THE METHODS OF INTENSIFICATION OF TRACKS IN NUCLEAR EMULSIONS. J.P.Lonchamp and M.Morgenthaler-Metz.
J. Phys. Radium, Vol. 16, No. 10, 803-10 (Oct., 1955). In French.

Different chemical methods for the intensification of tracks in nuclear emulsions have been studied systematically. Bleaching the image with oxidizing agents like chlorochromate or ferrocyanate is found to be unreliable. The best results are obtained by a mercurous chloride-bromide mixture. The solution found to give the most reproducible results is one containing 3% $HgCl_2$ and 3% KBr, the emulsion being soaked in this for 30 minutes. The emulsions are redeveloped using amidol. The technique has been used to intensify the electron tracks resulting from the radioactive decay of Co^{60}.

D.J.Prowse

778.34

864. THE SCATTERING-IN CORRECTION. B.A.Chartres and D.A.Tidman.
Proc. Phys. Soc. A, Vol. 68, Pt 10, 841-51 (Oct., 1955).

In experimental work with nuclear research emulsions, one sometimes makes scattering measurements to determine the energy distribution of a beam of particles incident on the emulsion. To do this, one selects particles which leave tracks longer than a certain minimum length. This sample is a biased sample, and a correction for this bias has been calculated, considering both single and multiple scattering. A.